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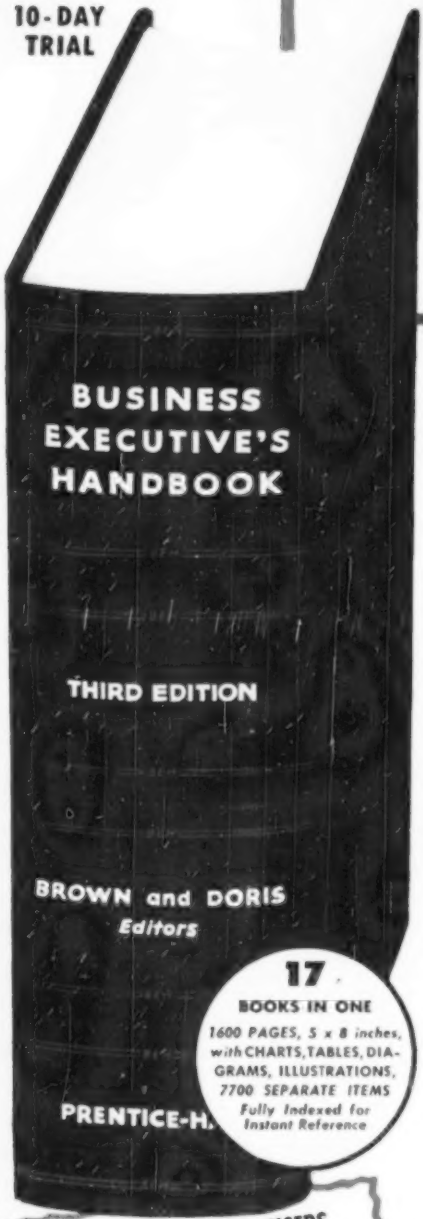

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Features FOR NOVEMBER, 1950

The Cover:

Artist Ray Puch shows you a logical development of the Air Force's detachable-fuselage plane.

Pack Plane Drops Combat HQ.....98

This truck-trailer of the air may revolutionize the whole concept of military—and civil—transport.

Shaw Previews Studebaker's V-8..110

Wilbur Shaw takes you for a ride in the 1951 Studebaker powered by a brand-new V-8 engine.

What Tanks Do We Need?.....117

In Korea we got caught with our armor-plated breeches down. Here's what we're doing about it.

5-Way TV Mast Stretches Tallest Building 132

Five TV and three FM stations join antennas atop New York's super-skyscraper to improve reception.

No-Nails House Hooks Together..138

A tricky locking system hooks panels together to make prefab houses of any size and shape.

Willys Tries F-Head Engine.....152

Willys reaches back into yesteryear for an engine head and comes up with a big surprise.

The Truth About Tiling a Floor....177

It isn't too hard, but there are some tricks you need to know. PS shows you the right way to do it.

Gus Saves a Birthday Party.....190

When a pixilated gas gauge threatens to bust up a marriage, the Model Garage Man hits on the hex.

Is Your Antifreeze Harmful?.....202

If you've got a good engine and want to keep it that way, learn how to spot the dangerous types.

Professional Designs for Amateur Santas 207

Toys with top styling that you can make—a mounted cowboy, a tractor, and an animated seal.

Music Without Knobs.....215

This child's phonograph will be a sure hit on your gift parade with kiddies and parents alike.

8 Tips on Judging a TV Set.....221

These simple tests will help you buy intelligently when you go shopping for your television receiver.

Dart Drops 7 Miles to Try Wings.....108

Boxcar Doubles as Reefer.....115

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73 Kites Fly on One String.....128
Biggest Blimp to Fight Subs.....136
Jet Engine Gets New Lease on Life.....142
Balanced Ball Built Around Wax Mold....144
Soil Doctor Prescribes for Crops.....156
Glass "Igloo" Stronger than Steel.....162
Homemade Racer Hugs the Road.....165
What's Inside a Fountain Pen?.....166
Aluminum Car Big But Light.....172

Mechanics & Handicraft

Door Does Double Duty.....183
Christmas Gifts from Your Shop.....186
Do You Need Nonstop Wipers?.....189
Making Seat Covers Saves Money.....195
Installing Ready-Made Covers.....199
Extension-Cord Reel Uses Swivel.....200
Winter Driving Tips.....201
Learn to Shoot With Light.....212
Vise News.....219
Your Shop Can Be a Souvenir Factory....225
Drill Stand Makes Doweling Easy.....228
Use Your Saw as a Jointer.....234
8-Tooth Blade Cuts Smoother, Safer.....238
Anyone Can Build New Model Engine....239

Departments

Letters 14
New Ideas from the Inventors.....105
I'd Like to See Them Make.....164
Keeping the Home Shipshape.....169
Aids to Modern Living.....174
Hints from the Model Garage.....193
New Shop Ideas.....232
Craftsmen at Work.....236
Mechanics of Farming.....246
New Tools.....282
P.S. Last Minute News and Notes.....286

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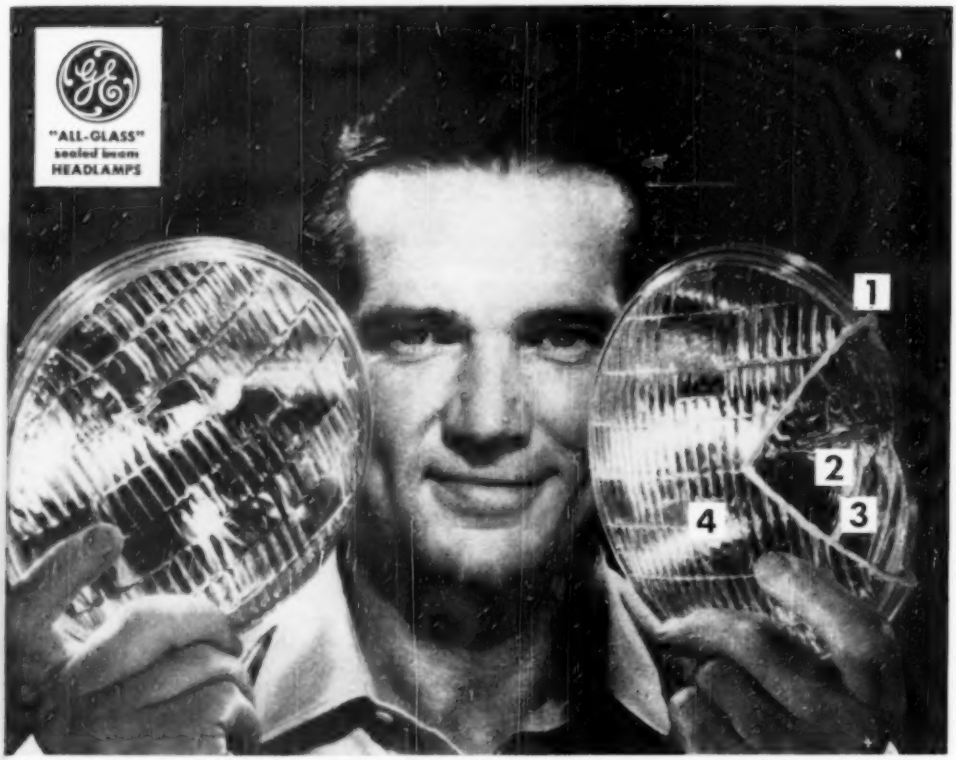

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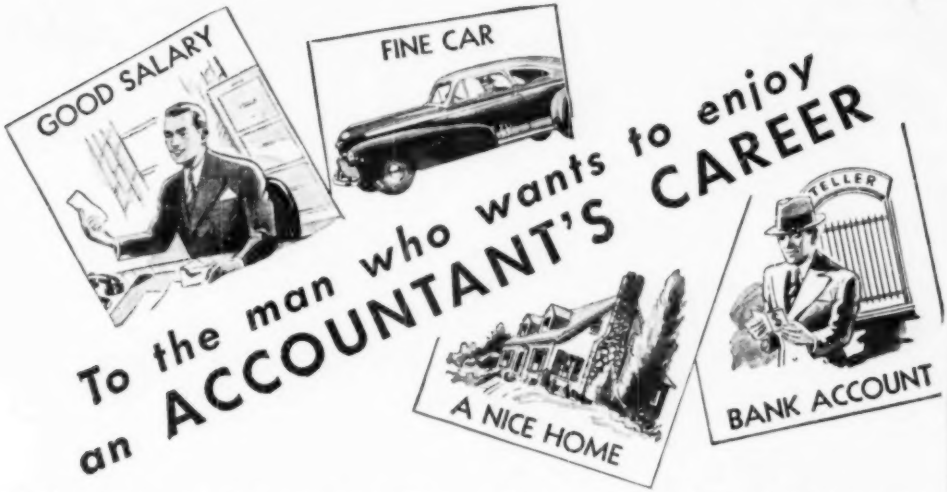

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Address.....

City, Zone & State.....

I Trained These Men

E. J. STREITENBERGER, New Boston, O., ... ing course, I ma... week fixing set... time. Now se... Television sets

PHILLIP G. ... Louisville 8, K... have been oper... Servicing busi... years I did $14... business; net p...

S. W. DINWIDDIE, ... ville, Ill., writes, "S... finishing course, wo... servicing shop. No... Engineer of WCUN ... Police Radio Instal...

A. HERR, New C... Pa., writes, "Hav... doubled my salary since start... ing in Radio full time. Am employed by Station WKBO as transmitter operator. Future looks bright to me."

L. HAUGER, San Bruno, Calif., tells us, "I accepted a position as Radio and Television Technician . . . promoted to manager of Television Service and Installation."

LEANDER ARNOLD, Pontiac, Mich., says, "While learning, made $5 to $10 a week repairing Radios in my spare time. Now I have a spare time shop in my home."

NORMAN H. WARD, Ridgefield Park, N. J., writes, "4 years ago, I was a bookkeeper with a hand-to-mouth salary. Now I am employed by a key ABC station."

H. B. MILLS, Washington, Ohio, finds, "Word traveled fast in regard to my N.R.I. training. Have been doing Television installation and servicing, tracing out and eliminating interference, etc."

C. STAETH, Fort Madison, Iowa, informs us, "Do Radio Servicing full time in my own shop and am making more money than ever before. I owe this to N.R.I."

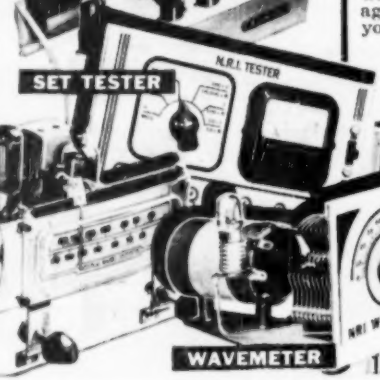
T. S. NORTON, Hamilton, Ohio, says, "My first job was obtained for me by your Graduate Service Department. Am now Chief Engineer, Station WQOX."

W. R. NIC... writes fro... ...g in ...trol

I'll Train You RADIO-

PRACTICE SERVICING OR COMMUNICATIONS *with Radio Kits I Send*

For both my Servicing Course and my NEW Communications Course, I send you many Valuable Kits of Parts for PRACTICAL EXPERIENCE. They "bring to life" theory you learn in my illustrated texts. Some equipment from both courses is shown below. As part of my Servicing Course, you build a complete, powerful Radio Receiver, a Set Tester useful in earning extra spare time money, an A. M. and F. M. Signal Generator, etc. In my Communications Course, you assemble a low-power Broadcasting Transmitter that shows how to put a station "on the air," a Wavemeter, an Electronic Multitester for measuring voltage, current, resistance, impedance, etc. This and other equipment you build with Kits I send is yours to keep.



Make Extra Money in Spare Time While Learning

Many of my students earn money fixing neighbors' Radios in their spare time while learning, often average $5, $10 a week. I send you SPECIAL BOOKLETS that show you how to do it . . . and I send parts to build a Tester that helps you do it.

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Do you want good pay, a bright future, and security? Want your own profitable shop? Get into fast growing, prosperous RADIO-TELEVISION! Radio alone is bigger than ever, 81 million home and auto Radios, 2,700 Broadcasting Stations, expanding Aviation and Police Radio, Micro-Wave Relay, Two-Way Radio are making opportunities for Servicing and Communications Technicians and FCC-Licensed Operators.

Television is TODAY'S Good Job Maker

In 1949, almost 3,000,000 TV sets sold. By 1954, 20,000,000 TV sets estimated. 100 TV Stations now operating. Authorities predict 1,000 TV Stations. This means more jobs, good pay for qualified men all over United States and Canada.

No Previous Experience Needed

Keep your job while training. Hundreds of successful RADIO-TELEVISION TECHNICIANS I trained had no previous experience, some only a grammar school education. Learn Radio-Television principles from illustrated lessons. Get PRACTICAL EXPERIENCE. See on the opposite page some of the devices my students build from Kits of Parts I furnish; also practice servicing Radios or operating transmitter . . . experiment with circuits common to Radio and Television. Many of my students make $5, $10 a week extra fixing neighbors' Radios in spare time while training. Many start their own profitable Radio-Television sales and service business, using these earnings as capital.

Send Now for 2 Books FREE—Mail Coupon

Send now for my FREE DOUBLE OFFER. You get actual Servicing lesson to show how you learn at home. Also my 64-page book, "How to Be a Success in Radio-Television." Read what my graduates are doing, earning; see equipment you practice with at home. Send coupon in envelope or paste on postal. **J. E. SMITH, President, Dept. OMP3, National Radio Institute, Washington 9, D. C. OUR 37th YEAR.**

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- ★ Sander disc revolves at constant high speed. Sanding table tilts up or down 45° as shown on Angle Indicator.
- ★ UL approved pushbutton switch, cord—fast, convenient starting and stopping.

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Letters

Another Cord Fan

Sir:

I am preparing a paper on automotive design and have been referring to POPULAR SCIENCE to supplement my information on what people are thinking and saying about the subject. And it was with great delight that I found you have readers who still defend the old Cord and Duesenberg designs [PS, March, p. 20].

I own an 812 Cord mellowed by 194,000 miles. On a recent trip from New York to South Carolina it got 16 miles to the gallon but used seven quarts of oil. Now I'm wondering if I shouldn't replace the original rings. A mechanic I was talking with about it told me of another Cord owner who was complaining that, after 204,000 miles, there was a foreign noise in his gear box.

One more Cord story and I'll stop: Last summer I was riding with a mechanic in an 810 convertible when we came across a

Caddy who wanted to race. He could only do an indicated 108 m.p.h., so we shifted into fourth gear after passing.

WILLIAM D. STRAYHORN
New York, N. Y.

Proof Enough

Sir:

I am writing to protest a statement in the article on our Fire Department in your September issue, page 124. The part I object to reads, "The town of Trenton, Mich., couldn't afford a real fire engine." We feel that ours is one of the best equipped fire departments in the country for towns the size of Trenton.

Our equipment includes: one of the most modern Mack 750-g.p.m. pumpers, received about a year ago at a cost of $16,000; a 500-g.p.m. pumper; a late-model chief's car; the Dodge pick-up shown in your picture; and all latest minor equipment. We

INVENTORS

Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the Patent Laws. For that reason, unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

A specially prepared booklet entitled "Patent Guide for the Inventor", containing detailed information with respect to patent protection and procedure, together with a "Record of Invention" form will be promptly forwarded to you without obligation upon request.

CLARENCE A. O'BRIEN & HARVEY JACOBSON

Registered Patent Attorneys

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TRAIN IN MIAMI—AIR CAPITAL OF THE WORLD

are right now in the process of installing two-way radios in our motorized equipment. Our city is protected by a Gamewell fire-alarm system. And our Fire Department budget is so set up that we could replace or purchase any equipment we might need.

This should be proof enough that your statement was in error.

C. T. WALLDORF,
Chief, Fire Department

Trenton, Mich.

Whatever Became of . . . ?

Sir:

Why not give us something on the Custer

"channel wing?" (See photo enclosed.)

ROBERT A. LAEDLEIN

Pittsburgh, Pa.

The Custer channel-wing airplane was, at last report, still in the process of development. The latest of several mentions of this wing in PS appeared in October, '49, p. 111.

Fire Prevention

Sir:

I question the advice in your August issue, page 161, that oily shop rags be kept in a closed coffee can to avoid spontaneous combustion.

Spontaneous combustion, as I understand it, is the result of slow oxidation. This gradually builds up heat to the kindling temperature, and the rags burst into flame. Ventilation, then, should disperse the heat and thus prevent fire.

FRED DWORSHAK

St. Albans, Vt.

Storing oily rags in a closed can will not

INVENTORS

If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

Unless you are fully familiar with the U. S. Patent Laws, we recommend that you engage the services of a Registered Patent Attorney to protect your interests. The patent laws are *your* laws. A patent gives you the right to prevent others from making, using or selling the invention claimed in your patent for a period of 17 years.

Use these patent laws for your protection. Investigate whether your invention can be patented. If you have what you believe to be an invention, we suggest that you have this firm make a search for you.

Send for a copy of our Patent Booklet entitled "How To Protect Your Invention," containing information about patent protection and patent procedure. Along with this we will also send you an "Invention Record" form, for your use in writing down and sketching details of your invention. We will mail them promptly. No obligation. They are yours for the asking.

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prevent oxidation, but will so retard it as to make fire unlikely. And if fire should occur, it would be confined to the can.

Incidentally, if the oil in the rags is mineral oil, there's no danger of oxidation. Only animal and vegetable oils oxidize.

Mouthful

Sir:

Your "Last minute news & notes . . ." for August, p. 246, states that in 500,000,000,000,000,000,000,000,000,000,000,000,000,000 years half of the radioactive atoms of Tellurium 130 will have decayed. Just how do you say 500,000,000,000,000,000,000,000,000,000,000,000,000,000?

Jack Crowe

Camp Hill, Pa.

You can say "five hundred thousand trillion trillion trillion" or, in mathematicians' lingo, "five times ten to the forty-first"— 5×10^{41}.

UN Flag Kits

Sir:

As a follow-up to your article on how to make a UN flag [Oct., p. 197] your readers may be interested in knowing that flag-making kits are available through the National Committee on Boys and Girls Club Work, a non-profit organization, at 59 East Van Buren Street, Chicago 5, Illinois. The kit, including materials and patterns, costs $2.25.

Kenneth H. Anderson,
Associate Director

Chicago

Magnetic Fluid Brake

Sir:

Whatever became of the electromagnetic fluid clutch developed by the National Bureau of Standards and reported in your magazine of June 1948, page 83? That looked to my untutored mind like the answer to a mechanic's prayer for a simpler automatic drive for automobiles. All that would be needed would be an automatic rheostat to adjust the current to the load on the engine.

Philip Marsh

Iowa City, Ia.

Though still not worked up to the prac-

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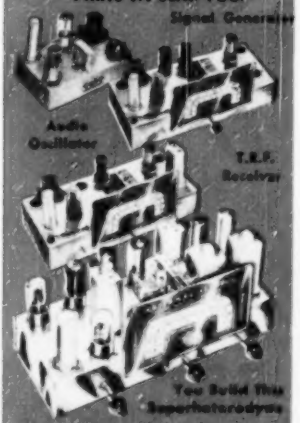
YOU BUILD ALL THESE AND MANY OTHER UNITS WITH PARTS WE SEND YOU:



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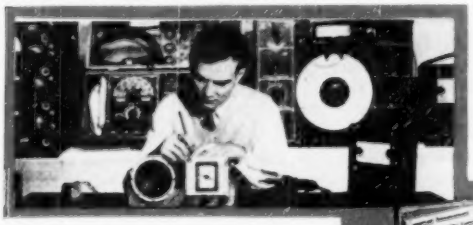

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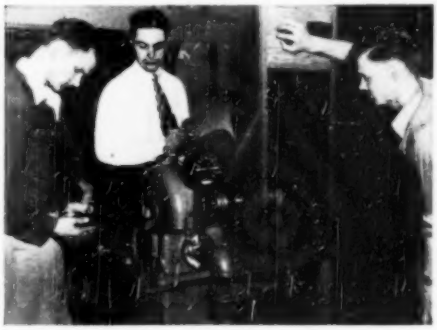

plied. The picture shows the magnetic brake, right, slowing and stopping a water turbine as the man at left measures the shaft torque. A ribbon of fluid only 1/25 of an inch thick is confined between the outside of the brake drum and a rotor. A magnetizing coil, fed through the control at upper right, is embedded in the brake drum. The rotor has a diameter of 8 inches and a braking face 3½ inches wide.

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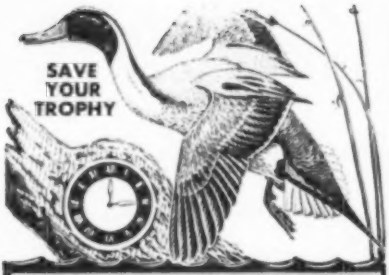

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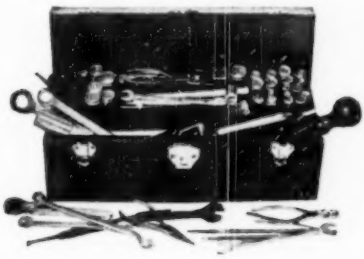

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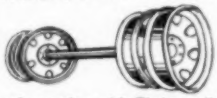

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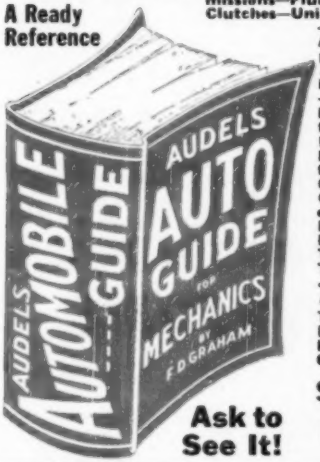

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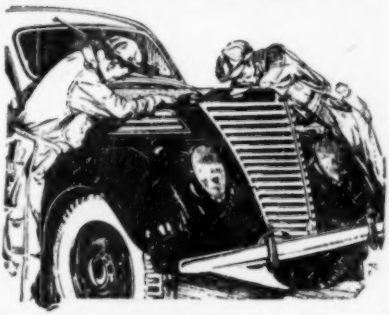

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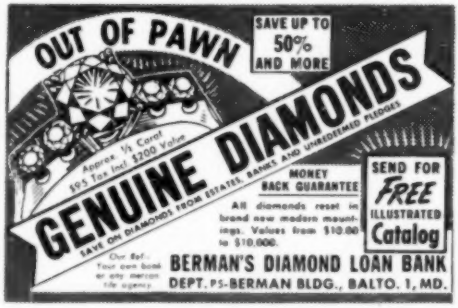

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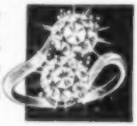

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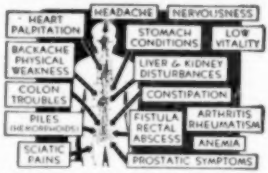

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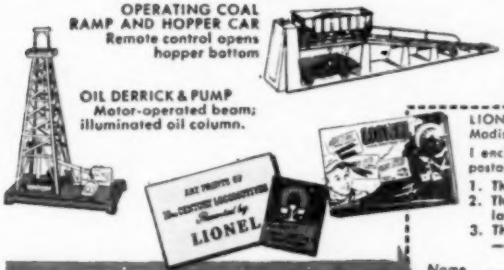

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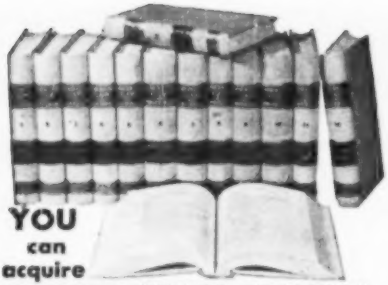

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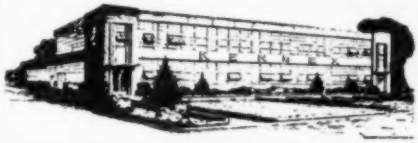

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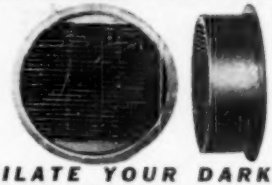

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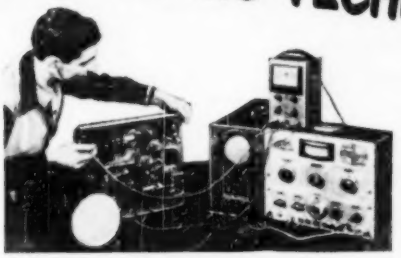

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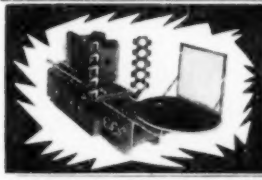

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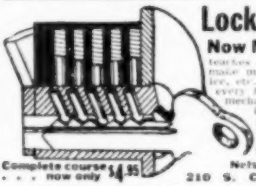

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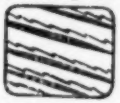

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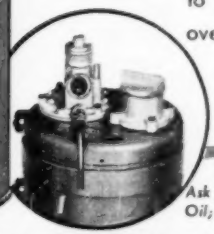

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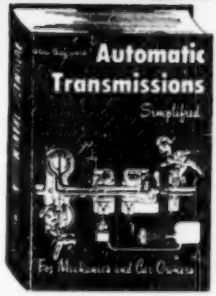

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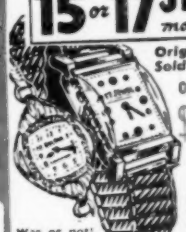

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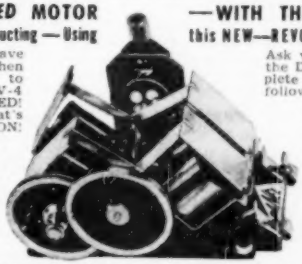

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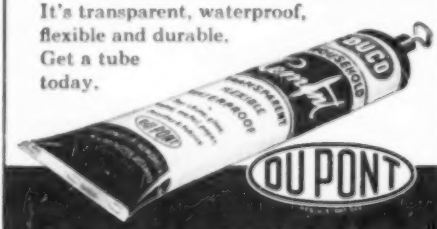

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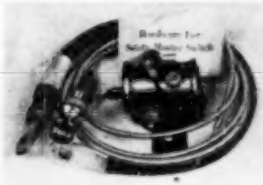

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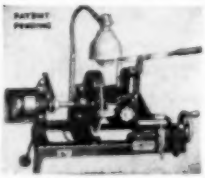

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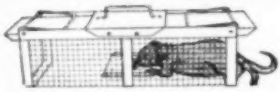

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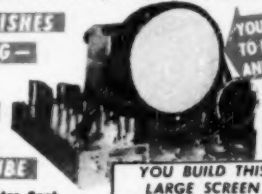

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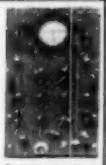

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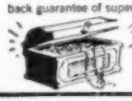

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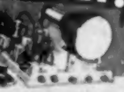

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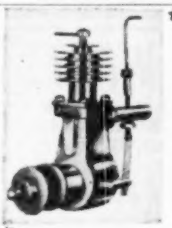

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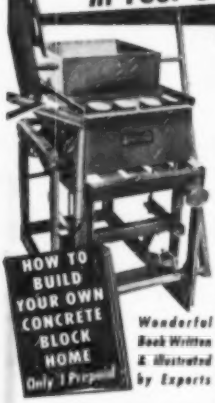

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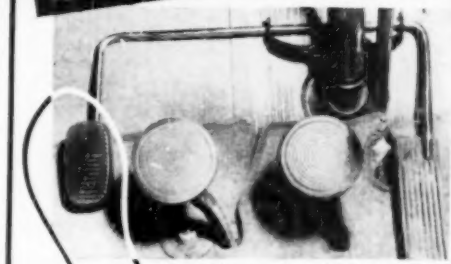

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700-16	5.96	700-15	6.56	700-20	10.96	1100-20	17..56
750-16	6.96	710-15	6.36	32x6 (6)	10.56	1200-20	18.56
550-17	5.96	760-15	6.56	32x6 (10)	11.96	1000-22	15.56
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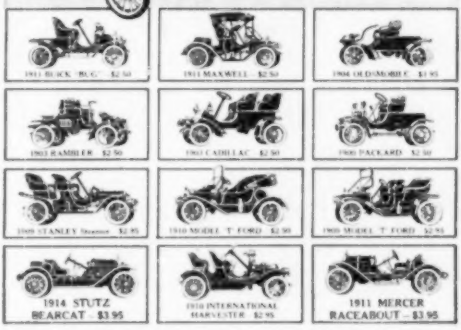

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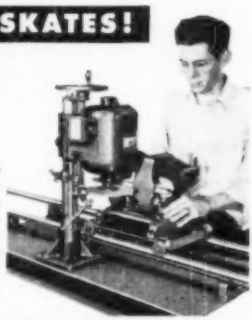

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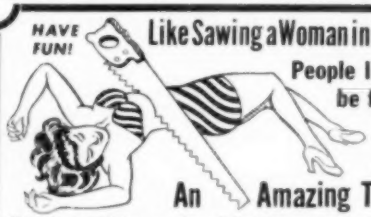

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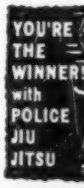

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MAKE flexible molds! Cast plaques, bookends, figurines! Free sample! H. Tooker, 630-A Chestnut, Hamilton, Ohio.

MOLD Makers—Attention! Genuine Natural Latex for reproducing Statuary, figurines, plaques, etc. Instructions free. B. M. Barron, 77 Francis St., Everett, Mass.

SPIN Angora wool into yarn. Interesting work. House of Angora, PSM6, Springfield, Illinois.

YOUR own profitable home business. Preserve live flowers to last forever. Spare or full time. New discovery—simple—fascinating. No experience necessary. Send $2.00 for working equipment, instructions and valuable sales plans. Satisfaction guaranteed or money refunded. Hermansen, 210 Fifth Ave., Suite 1102, New York 10, N. Y.

FREE Illustrated course casting novelties. Genuine latex for molds. Major Chemical Co., 164 Portland St., Cambridge, Mass.

LIQUID Rubber, make flexible molds. Free Sample. Chaney, 1130 E. 16th St., Jacksonville 6, Fla.

COLORGLAZED Concrete Pottery made without molds. Patented method. Cemetery products, novelties, tiles. Basement leak-sealing. Money-making projects. Booklet, details free. Men only. National Potteries, Grand Rapids, "Minnesota".

GROW Plants, Flowers. Details Free. Shiffer, Box 129, Millersburg, Penna.

"EARN While you Sleep." Coin-radios. Johnny Kratz, Grantham 27, Pennsylvania.

REGRAIN-Refinish Automobile, Dashes-Mouldings. Furniture. Big profits. Write Outmah, 4323 So. 38th. St. Louis 16, Mo.

HOW To Set Up and Run A Mirror Shop! Resilver Mirrors. Make Chipped Glass Nameplates. Electroplating Salts and Rectifiers. John Sprinkle, V90, Marion, Indiana.

HOME spare time business. Free Literature. Magill Hamstery, Springfield, Mo.

METALLIZE Baby Shoes. Repair Dolls. Make Rubber Stamps. Silver Mirrors. Make Beautiful Figurines. Catalogue or "30 Ideas" Free. Universal, Box 1076-B, Peoria, Illinois.

NATURAL Molding Latex. Extra thick. Free Sample. W. Wooley, 115B Donald, Peoria, Illinois.

HOW and where to obtain Capital? Free details. Star Service, Wapakoneta, Ohio.

LEARN reweaving! Free Details. Frank Harris, 4333 South Carrollton, New Orleans, Louisiana.

FORGE ahead financially! Start profitable business; mail, locally! Amazing invention. Free sample offer! Consolidated Equipment Corporation, 782 Guardian Bldg., Cleveland 14, Ohio.

MAKE money making new greaseless doughnuts at home on electric machine. Wholesale to grocers, drug stores, cafes, hamburger shops. Send for free recipes and plans. S. Ray Company, 3605 South 15 Ave., Minneapolis 7, Minnesota.

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NEW Ideas—from other countries. 5000 different magazines—in English. Many single copies available. Free descriptive list. Caron & Son, 45-M Fairview Ave., No. Plainfield, New Jersey.

"ELECTROPLATING — Know-How" includes baby shoe metallizing, brush plating, chrome plating; other lucrative fields. Learn easily. Free details. Joseph B. Kushner Electroplating School, Stroudsburg 991, Penna.

NEW Proved methods get money by mail. Amazing eye-opening. Details free. Lexington Mail, 5538-B Lexington, Chicago 44.

FREE Formula for "Rub-On Silver Plate." Also "How to Electroplate for Profit," and other valuable information. Send name on postcard. S. Hyde, 327 West 120th Street, Los Angeles 61, California.

BUY Wholesale. Big-name items 40% and more below retail. Folks eagerly patronize you for big savings. Details free. Young's, Kent 1, Ohio.

WHERE To buy 600,000 Articles Wholesale. Details Free. Krueger, 3418 Wolcott, Chicago 13.

MADE Big Money, So Can You. Wamsteker, Box 34-E, Wynberg, Cape, Africa.

MAIL selling opportunities! Free. Messina P.O. Box 78, New Lots Station, Brooklyn 8, New York.

TIN Cans. Turn them into cash. Nine methods. Instructions 50c. Charles, 12-BPE, Norwood, Ohio.

$250 WEEK Reported! Free book "505 Odd Successful Businesses." Work home! Expect something odd! Pacific-E, Oceanside, California.

"YOU can actually see the metal flow on" with a portable Tyco Electro-Plater! Electroplate Metals, Mirrors, Wood, Glass, Leather, Plastics! Inexpensive, profitable home business. Free booklet. Tyco Metals, Box 8535N, Dallas 16, Texas.

$46 FROM Square Foot Plywood; Jigsaw necessary. Write: Woodart, Bridgewater, Massachusetts.

MAIL Selling opportunities galore free! Wehner, Box 142-E3, Roxbury 19, Mass.

BOOKKEEPERS earn $100.00 weekly operating simplified "Bookkeeping & Tax Service". Details Free. Universal Bookkeeping, Box 664-P, Springfield, Missouri.

REAL money making opportunity making Interlocking Concrete building blocks. Rex Products Co., Dept. 21, Piqua, Ohio.

BUY it wholesale. Manufacturers, Distributors. Over 850,000 items. Literature free. Olsen, 1231-B East Third St., Duluth 5, Minn.

NEW Industrial Hand Cleaner! Sensational product. Immense market. Tremendous possibilities. Unusual, money-making plan Free! Keenelo, 2438-D Fifteenth, Denver 11, Colorado.

CAN you use $35 week Extra? Operate mailorder business. Nacci, 7731 Heyden, Detroit, Michigan.

A PENNY postcard can put you in business. Big money! Full or part time. Sell amazing comfort shoes. Everybody needs them! Be your own boss. Selling outfit free. Write today. Consolidated Shoe System, Dept. CS-69, Chippewa Falls, Wisc.

MAKE $24,500 Using Formulas from "Schemer" Magazine. Box 775P, Alliance, Ohio. Year $2.00. Sample Copy 20c.

57 MONEY MAKING OPPORTUNITIES

LEARN Sewing Machine Repairing at home. Earn $125.00 week spare time. Plus, new machines, motors, etc. Wholesale. Free Particulars, Taylor Service Co., Hamilton, Ohio.

POPULAR SCIENCE OPPORTUNITIES

DETECTIVES Earn Big Money. Experience unnecessary. Detective Particulars free. Wagoner, P-125 West 86th, N. Y. 24.

INDEPENDENT income! Make leather belts, billfolds, purses. Big catalog and genuine steerhide keyholder, 10c. Tandy Leather, Box 397G, Tulsa, Okla.

ADDRESS mail circulars for advertisers. Complete instructions—List of firms—25c. Imperial, PS-11, Wilmington, N. Car.

SCHOOL Seniors — Earn sensational profits selling classmates America's Most Beautiful Graduation Name Cards. Largest selection. Outsells all others. Free sample kit. Printcraft Dept. P, 1425 E. Elm Street, Scranton 5, Pa.

QUICK profits taking magazine subscriptions, handling greeting cards. Cassell Publishers Service, Westfield, N. J.

COLORED and light reflecting crystals. Luminous pigments. Catalog and Samples 25c. Glowell Co., 475-E, Fifth Ave., N.Y., N.Y.

SHELLCRAFT! Make Beautiful Seashell Jewelry And Novelties. Income or Hobby. Supplies, Instructions. (Buy Direct) Pace's, Cortez, Fla.

VENDING Machines, Punchboards, Free Catalog. Tyrcha Wholesale, 4532 N. Meade Avenue, Chicago 30, Ill.

RAISE your business value, standing, as State Notary Public. Information, Stationers, Helotes 50, Texas.

6 RED Hot, slickest, legitimate ways make money quick! $2,000 three weeks, without investment. Rare information. Details 50c. Gift included may mean a fortune to you! Janlin (PS), Box 1140, Wilson, N. C.

EXCELLENT profits. Make fast-selling chenille Christmas poinsettias, corsages, Santas, monkey trees, dolls. Literature free. Veiva, Dept. X, Bohemia, N. Y.

NEW Patented Hobby-horse. It walks. It rocks. Exclusive territory. Manufacturing rights. Free details. Carl Markowski, Lewiston, Idaho.

WIN contest money. General Contest Bulletin gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests, 1609-A East 5th, Duluth, Minnesota.

BARGAINS, new and used arc welders. Electric or gas engine, AC or DC, all sizes, portable or stationary. Write needs. Hobart Welders, Box P-1104, Troy, Ohio.

ASSEMBLE and Sell Swiss Musical Churches Kit $3.95 Postpaid. Tremendous Seller. Piltzecker Imports, Wood-Ridge, N.J.

IF you are aiming at financial successes we may be able to suggest ways, means and methods. F. A. Alsen, Postbox 165, Chicago 90, Illinois.

EARN Money Evenings, copying and duplicating comic cartoons for advertisers. Adservice, Argyle 2, Wisconsin.

RESURFACE butcher's chopping blocks with easy, fast-working portable electric machine. Unique service in wide demand with little competition. Large, steady profits from full or part-time work. Hill Machine Co., Dept. P., 1041 W. State St., Rockford, Illinois.

AGENTS: New Household Necessity. Inquire Immediately. Miller & Miller, Rimersburg 1, Pa.

MONEY from Water, Salt and Air. Send $1.00 for copyrighted information. Box 1372, Des Moines 5, Iowa.

$250 WEEK Reported! Free book "505 Odd Successful Businesses." Work home! Expect something odd! Pacific-E, Oceanside, California.

58 FORMULAS, PLANS, ETC.

FORMULAS—All kinds. Latest products. Literature free. Kemico, Park Ridge 15, Ill.

10,000 FORMULAS and Trade Secrets. Free Literature. Stillmans, 555 Kingston Ave., Brooklyn 3, N. Y.

LOW cost wiring, construction, radio plans, engineered to your specifications. Island Engineering Company, P. O. Box 263, Great Neck, L. I., New York.

LABORATORY tested formulas. Lists free. Pont, Box 635-PS, Terre Haute, Ind.

PROFITABLE Formulas $1—Set: White Side Wall Tire Cleaner; Waterless Hand Cleaners, Auto-Cleaners — Polishes, Dry Cleaning Fluids, etc. Plastics, Box 1574, Boston 4, Mass.

59 PLASTICS

PLASTIC supplies, materials, instructions for hobby or business. Send for free catalog. Tells about internal carving. Hays Plastics, 1310 82nd Ave., Oakland, Calif.

INTERNAL carved roses, orchids, swans, goldfish, butterflies, etc. Jewelry and gifts. Crystal Floral Novelty Co., Bound Brook, New Jersey.

LUCITE, Plexiglas. Any size sheets, masked. Square foot (12 x 12) cost 1/16", 96c; 1/8", $1.25; 3/16", $1.52; 1/4", $1.80. Colors add 10%. Include 10% postage. Almac Plastics, 230 Fifth Avenue, New York 1, New York.

NEW Liquid plastic. Clear, colors. Cast without heat. Embed flowers, insects, coins. Saw, drill, carve. Send 25c for exciting new home project manual showing how to get started. Castolite, Dept. M-102, Woodstock, Illinois.

PLASTIC Sheets, Rods, Tubes, etc. Free List. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7, Mo.

COMPLETE line internally carved gifts and jewelry. Free catalogue. Pilot Plastics Co., 67B4 Fulton St., New York City 7, N.Y.

LUCITE, plexiglas, Acetate, 85 different colors, thicknesses. Immediate shipment from stock. Rod, Tube, Casting plastic. Wholesale, retail. Catalog, instructions, bargain lists, 10c. Gem-O-Lite, Box 686Y, North Hollywood, Calif.

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FREE Plexiglas listing. Unique Glass Shop, Box 4195 Richmond, Virginia.

PLASTIC Hobbycraft Project Manual. Ideal Gift $1.50 Postpaid. Material Catalog. Plastic's, Box 1812, Salt Lake City 10, Utah.

60 CHEMICALS AND APPARATUS

LUMINOUS Paints will glow in dark. Six colors. Fairmount Chemical Co., 136 Liberty St., New York City 6.

NEW Idea Chemical and Apparatus Outfits for Home Experimenting, Photo-Scales, Microscopes, Chemicals, Biological and Laboratory Supplies in Small Quantities. Catalog 15c. Established 1931. John H. Winn, 124-B West 23rd Street, New York 11, N. Y.

LABORATORY supply catalog, 10c. Rex Laboratories, 2849-B Birchwood, Chicago 45, Illinois.

CHEMICALS and apparatus for industrial, analytical, and private laboratories. Catalog 15c. Dept. M-26, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N.Y.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology. 10c. Tracey Laboratories, Evanston, Illinois.

LABORATORY Apparatus, Chemicals, Microscopes, Complete Chemistry Sets, Minerals, Uranium Ore. 10c brings catalog. Porter Chemical Company, Hagerstown 2, Maryland.

CHEMICAL Analysis taught free by mail under my personal direction. Beginner's basic course (or brush-up). $1.00 brings complete chemicals for beginning, and first lesson. J. H. Watters, Box 46, Bell, Calif.

61 HELP WANTED

INTERESTED in Latin American & Foreign Employment?????? $1.00 brings 1950 Copyrighted "Foreign Service Directory" World Wide Listings in Constructions; Oil, Mining; Aviation; Steamships; Manufacturers; Transportation; Exporters, Importers. Hot List Firms Hiring. How-When-Where to apply. Application form free. Global Reports, P. O. Box 883-S, Hollywood 28, Calif.

MAKE $20 a day! Sell Staybright Brass Name Plates for front doors. Write Hubstamp, 357-F Congress, Boston, Mass.

IMMEDIATE opening for 2 or 3 reliable men with car to call on farmers. No experience necessary. Steady work. $15 to $20 in a day. McNess Company, Dept. 265, Freeport, Ill.

ALASKA—Last Great American Frontier. $1.00 brings 1950 Copyrighted Directory & Government Map Free. Big Construction Projects; Fishing; Mining; Aviation; Hunting-Fishing-Game rules; Fur-Farming; Lumber; Live Stock; Agriculture, Homestead Land & Highway information. Listing firms hiring. Application form. Alaska Opportunist, P. O. Box 883-S, Hollywood 28, Calif.

FOREIGN Employment, Construction Men, Building Trades, Mechanics, Helpers, Office Men. Good workers interested in Foreign Development projects, Pipe Lines, Dams, power plants, Roadways, Shipping, oil Refineries, etc. Transportation and quarters furnished; High Wages. Listings of firms actively working on projects in Arabia, Persian Gulf, Africa, Alaska, Canada, South America, Europe, etc. Send $1.00 for Foreign Construction Compendium and Application forms. Foreign Service Bureau, Dept. PS-11 (Employment) P. O. Box 295, Metuchen, N. J.

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FOREIGN Projects Directory, $1.00. Foreign Service Institute, 1112 N.W. 18th Place, Miami, Florida.

FOREIGN Employment Information?? List of Overseas projects with Application Form: $1.00 (C.O.D. $1.32). Wentworth & Company, Box 3980, Miami, Florida.

$1,000,000 CONSTRUCTION Job-Project Report, $1.00 brings Monthly News Bulletin giving authentic projects starting "World Wide" USA; Alaska; Canada; Pacific; Arabia; Latin America; India; Mexico; Africa; Europe. Tells How-When-Where to apply. Global Reports P. O. Box 883-PX, Hollywood 28, Calif.

62 AGENTS WANTED

EXCELLENT Sideline for printing and advertising salesmen. Decalcomania name plates in small quantities. Great demand. Also, make money with our line of Automobile Initials and Sign Letters. Free Samples. "Ralco", XL-Roxbury, Boston 19, Mass.

CASH in on tremendous demand for new low priced burglar alarm for cars, homes and farm building. Nothing like it. Everybody wants one. 286% profit. Unique sample offer. Northwest Electric Co., Dept. I-20, Pukwana, S. Dak.

WHERE To Buy 800,000 articles direct from Manufacturers. Save by buying direct. Sent Free. "Your Profits Under the Spotlight." Glass Pub. Co., Ellwood City 1, Pennsylvania.

1950 XMAS Card catalog ready! Earn more money as a wholesale jobber! Large selection of dollar box assortments. Imprints, Religious, Personalized Christmas Cards! Three dollar sample boxes $1. Postpaid! Write for Free Holiday Bulletin. Elfko, 438 North Wells, Chicago 10.

COMMERCIAL Deep Frying Course. Mock Chicken Legs, Potatoes, New and proven methods. Learn about this money-making field. $2.50. PP. Concession, Toledo 13, Ohio.

NEW Jobs open in selling! Send name, address for five free issues of Opportunity Magazine's money-making guide, listing hundreds of companies who'll pay you well, full or part-time. No experience needed. Opportunity, 28 E. Jackson, Dept. 18, Chicago 4, Illinois.

BIG Bargains for big profits. Over 100 sensational values. Men's used suits $2, pants 25c, topcoats $1.25, overcoats $2, shoes 20c. Experience unnecessary. Free wholesale catalog. Superior, 1250-B Jefferson, Chicago.

FREE Samples, and amazing plan, giving you Gorgeous Dress without penny cost. Rush name today with dress size. Harford, Dept. C-535, Cincinnati 25, Ohio.

POPULAR SCIENCE OPPORTUNITIES

DRESSES 18c; Coats $1.00; Blouses 35c; Free Catalog; Crown, 164-PB Monroe St., New York 2.

SELL new clothing. Lowest prices. Operate from home, auto, store. Enormous Profits. Big catalog free. S & N, 565-AB Roosevelt, Chicago 7.

FAST profits—No investment. Send for big, free catalog. Plastic aprons, tablecloths, etc. 150 sure-fire items. We guarantee sales. Write The Halliday Co., Dept. P-11, 15-19 Pennington Ave., Passaic, N. J.

START Your Own Business on credit. Always your own boss. 1559 Dealers sold $5,000 to $28,000 in 1949; their average $6,834. We supply stocks, equipment on credit. 200 home necessities. Selling experience unnecessary to start. Wonderful opportunity to own pleasant profitable business backed by world-wide industry. Write Rawleigh's, Dept. K-U-PSC, Freeport, Ill.

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FREE SAMPLES. Big profits showing amazing Glow-in-the-Dark specialties. House numbers, pictures, plastic novelties, ashtrays, keyholders, religious and nursery objects, etc. Madison Plastics, 303 Fourth Ave., New York 10, N. Y.

AGENTS—Big Line Including Food Products. Fast selling premium and bargain deals. Low prices. Send card for big outfit offer with gift. Ho-Ro-Co., 2771 Dodier, St. Louis 7, Mo.

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THERE'S big money taking orders: Personal Initialed Buckles with Belts, Tie Holders, choice of over 3,000 Emblems, Cap and Breast Badges for every purpose, Uniforms, Work Clothes. Embroidered with company name, trademark, sales message, etc. Prospects everywhere. Latest styles, finest fabrics. Write for selling kit. Hook-Fast Co., Box 480PS, Roanoke, Va.

NEW Plastic Mending Tape. Just press on! Repairs clothing instantly. Lightning seller. Samples sent on trial. Kristee 159, Akron, Ohio.

CHRISTMAS Cards, Personalized Gift Items. Raum, 4154-B Fifth Street, Philadelphia 40.

ADVERTISING book matches—Cash in on big demand—sell Union Label matches. Cuts for all businesses and political parties. Free powerhouse selling kit—low prices, protection guaranteed on repeat orders—Cash commissions. Superior Match Co., Dept. P-1150, 5530 Greenwood, Chicago.

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WRITE for free booklet and catalog telling how to earn substantial profits in your spare time by forwarding new and renewal subscriptions to all magazines for your friends and neighbors. Oldest U. S. Agency. Established 1869. Moore-Cottrell, North Cohocton, New York.

SCHOOL Seniors! A postal will bring you our wonder Kwick-Sell Cardalog of popular Graduation Name Cards. Biggest profits! Only firm giving free Golden Memory Book and Souvenir Chest. Don't miss out. Hurry that postal! Craftcards, Box 235 (m), Pittsburgh 30, Pa.

NEW novel plastic "slideon" pricing sets sell fast to stores, manufacturers, others. Exclusive features. Take easy orders—collect big profits. Free starting outfit. Mastercraft, 223 Tyler, Dept. PS-1, Trenton, N. J.

AGENTS—300% profit selling genuine gold window letters; stores and offices. Free samples. Metallic Letter Co., 437 N. Clark, Chicago.

FREE! Let me send you food and household products to test in your home. Sell your friends, make money. Rush name. Zanol, Dept. 8091-L, Richmond St., Cincinnati 3, Ohio.

NEWEST money making sensation. Sell personal initialed belts, buckles, cap and breast badges, tie holders, etc. Choice 2000 emblems. Write Special Outfit Offer today. Hook-Fast, Box 1425PS, Providence, Rhode Island.

STRANGE "Dry" Window Cleaner. Sells like wild. Replaces messy rags, liquids. Simply glide over glass. Samples sent on trial. Kristee 158, Akron, Ohio.

NEW Amazing Revolutionary Item. Every housewife a prospect. For further details, write Lor Distributing Co., 930 Delaware Avenue, Bethlehem, Penna.

FREE sample nylon stocking of world's only nationally advertised hosiery line actually guaranteed against runs, snags or excessive wear, regardless of cause! It's amazing but true. Every weight from sheerest 15 denier to heavy 70 denier—all gauges to luxury 60 gauge. Amazingly low prices, starting at $1.08 prepaid for sheerest 15 denier 51 gauge. Not sold in stores. Good Housekeeping Guarantee Seal. Also complete line men's hosiery guaranteed one full year or replaced free. Full variety lingerie in crepe, satin and nylon, featuring all nylon slip at $2.95, satin slip at $1.58, etc. Housecoats and robes. Kendex sales people will earn one million dollars this year. Get your share. No money or experience needed. Pay nothing now or later. Just show free outfits. Write orders. We deliver and collect. Advance cash plus huge bonus. Earn money spare or full time. Become manager—appoint others to sell for you—earn steady income on their sales. Man or woman—young or old, you can earn more money than you ever thought possible. Everything you need is furnished free and prepaid, including nylon stocking, samples of materials, sales books, 36-page salesmanual, color cards, etc. Simply write your name and address on postcard and mail to Kendex Corporation, Babylon 84, N. Y.

$2.50 STARTS You in Jewelery business. Sell 14K Gold Neckchains "Flat-curb" $6. cost you $2.50. Others: $8.40 for $3.50; Heavy $12.00 for $5.00. Earn big money spare or full time. Also sell Nylons, Slips, briefs. Become Manager, you get 40c for every $1.00 your Agents earn. Ergim Company, 992 Columbus Ave., New York.

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ADVERTISING novelty. Fits over telephone dial. Fast outstanding seller. Liberal commission. Free samples. Acme Mfg. Co., 67 Chelmsford St., Boston 22, Mass.

TO $35.00 Weekly. Spare Time. Home Operated. Mail Order Business. Successful Small "Beginner's" Plan. Everything Supplied. Lynn, 5710-C Bankfield, Culver City, California.

$1.00 STARTS you in business. Sell men's neckwear full or part time. Low investment, big profits. Send $1.00 receive sample tie. Free color catalogue, selling plan, wholesale price list. Radio City Neckwear, Dept. PS-7, 112 W. 50th, N. Y. C. 19.

MEXICAN feather pictures. Sell on sight; 200% profit! Free details; sample 10c stamps. Sylvia-SH, Apartado 9036, Mexico City.

GOLD lacquered Window Sign Letters. Large Sizes Penny Each. New foils. Absolutely Beautiful. Free Samples. Atlas, 544 W. 79th, Chicago 20.

JEWELRY For Salesmen Distributors Direct Factory. Catalog Free. Pickcraft (c 19) Bank St., Attleboro, Mass.

ESTABLISH A Mail Business with your own Exclusive Item. Idea to Mailbox service. Planning — Preparation — Production. Descriptive booklet Free. National, Box 88-V, Dorchester, Mass.

ALL-PURPOSE power mowers, 10" wheels. Gas-electric. Rctacut, R-2001, Excelsior Springs, Missouri.

NYLONS Direct from mill. Sample free. Guaranteed against runs. No experience or money needed. Also Nylon slips, briefs. Earn big money spare or full time. Become Manager, appoint agents. We pay you 40c for every $1 your agents earn. Sell 14K Neckchains "Flat-Curb" $6. cost you $2.50. Ergim Co., 992 Columbus Ave., New York.

OWN A Big Moneymaking Used Clothing Business. Men's used suits $2, pants 35c, topcoats $1.25, jackets 60c, shoes 20c. No experience necessary. Free wholesale catalog. Superior, 1250-B Jefferson, Chicago 7, Illinois.

PERFUME—Sideline to Independence. Learn All—Free—"International". 6347 Parnell PA-11, Chicago 21, Illinois.

IS $210 a week worth a penny postcard to you? Then rush card with name and address for special Free Trial Plan that sells amazing new Automatic Refrigerator Defroster "like hot cakes!" Write to Mr. Lewis, D-Frost-O-Matic Corp., Dept. PSC-11, 6 N. Michigan, Chicago 2, Ill.

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AGENT Or Exclusive Distributor For Cigarette Lighter Manufacturer. Macgregor, Tahoe Valley 15, Calif.

$250 WEEK Reported! Free book "503 Odd Successful Businesses." Work home! Expect something odd! Pacific-E, Oceanside, California.

BUY thousands of nationally advertised products direct from manufacturers and distributors. Write for "Buy Direct and Save." Service Publishing, 1420-B Investment Bldg., Pittsburgh 22, Pa.

SELL!! Balloons, Combs, Specialty Merchandise. Carleton House Distributors, Texas City, Texas.

TALKING Christmas Cards; pull tape and card clearly says "Merry Christmas". Fascinating 150% profit. Sample $.25 or 5 for $1.00 with wholesale prices. Minas, 2001 Main, Santa Monica, Calif.

63 HIGHGRADE SALESMEN

SALESMEN—Sell America's finest, biggest line of Advertising Specialties. Sensational sellers to all types of business. Big Commissions Advanced. Sensational sales plan nets you top earnings. Free Outfit. Charms & Cain, 407-PPS South Dearborn, Chicago 5, Illinois.

BIG Money Taking Orders; shirts, ties, sox, pants, jackets, sweaters, shoes, uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-EK, Lincoln, Chicago.

LOOK Here! Wanted—Men and women to start in business on credit. Sell some 200 farm-home Products. Thousands of our Dealers now make quick sales, big profits. For particulars write Rawleigh's, Dept. K-192-PSC, Freeport, Illinois.

BUILD Your Own Business—Sell nationally known cushioned sole Charles Chester Shoes direct from our factory established 1876. Complete line for entire family. Full time or side line. Advance commission up to $2.50 per pair plus generous monthly cash bonus. Samples and equipment free to producers. Chas. Chester Shoe Co., 140 Foundry St., Brockton, Massachusetts.

EARN Big Money Fast! Sell finest-quality advertising work uniforms to garages, factories, filling stations, etc. Free selling kit. Topps, Dept. 5411 Rochester, Indiana.

AD Matches! Sell Amazing Designs—20, 30, 40 and 240-light book matches. Big spot cash commissions; every business a prospect. Low prices for high quality. Repeats. Start without experience; men, women; full, part time. Buy Nothing! Sales kit furnished. Match Corp., Dept. PS-11, Chicago 32, Illinois.

SHINER-HOOK: New Sensational seller. Fishermen dealers. Sample 10c. Catalog. Nelson Company, St. Paul 2, Minnesota.

POPULAR SCIENCE OPPORTUNITIES

INVENTION Long Needed. Established company offers exclusive territory, big profits. Huge list of prospects. Easy demonstration. Free outfit. Write Red Comet, Inc., Dept. 774, Littleton, Colorado.

67 EDUCATIONAL AND INSTRUCTION

PIANO Tuning Pays. Learn this profitable profession at home. Our Tonometer and mechanical aids make learning easy. No knowledge music necessary. Diploma granted. Largest and oldest school—51st year. G. I. Approved. Write for booklet. Niles Bryant School, 77 Bryant Bldg., Washington 16, D. C.

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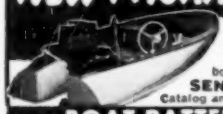

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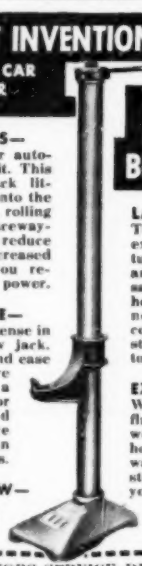

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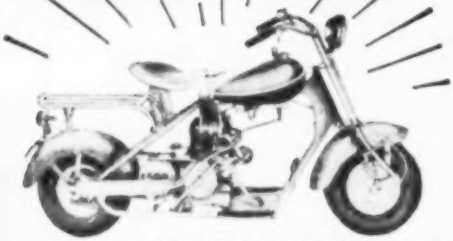

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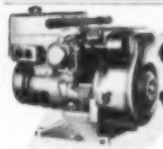

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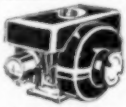

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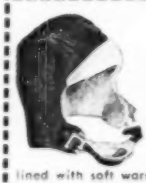

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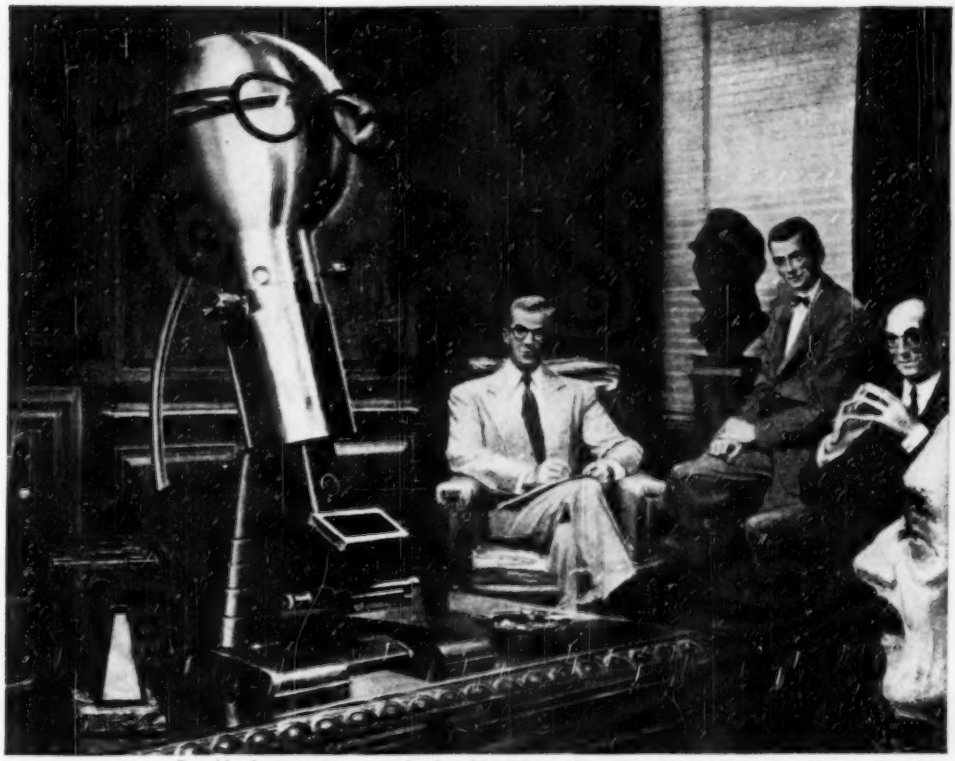

Portable electron microscope, developed by RCA, widens research in universities, industries, hospitals.

The new instructor gets a hearty welcome

You've read, in both newspapers and magazines, about the powerful electron microscope. Now this amazing "instructor" of scientists and physicians becomes even more useful -- in more research fields.

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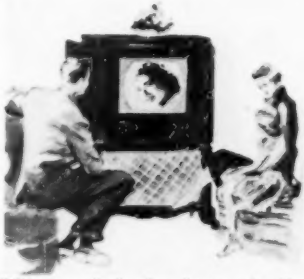
See the latest wonders of radio, television and electronics at RCA Exhibition Hall, 36 West 49th Street, N. Y. Admission is free. Radio Corporation of America, Radio City, New York 20, N. Y.



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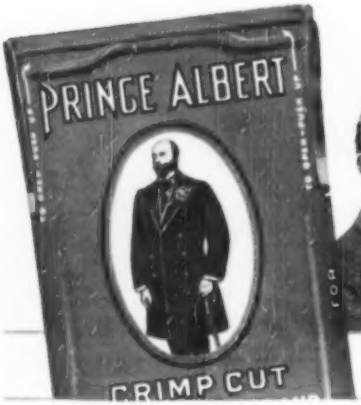

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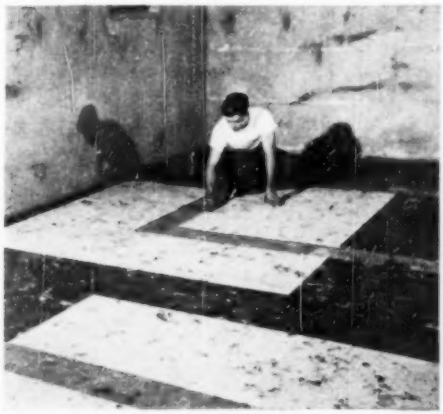
The National Joy Smoke

Popular Science *Highlights* this Month

Tanks are tested on the battlefield as well as on the proving ground. Read how this M-46 Patton stacks up against Red armor. **Page 117**

Calling amateur Santas! Here are simple designs that will enable you to turn odds and ends into attractive toys. **Page 207**

Basketballs have grown up since the days when peach baskets were the target. Making them is an intricate, precise job. **Page 144**



There are tricks to tiling a basement floor. But follow these tips and you'll get more use and fun out of your cellar. **Page 177**

Your hand can't compare with these homemade racks as a neat way of holding a fistful. They make fine Christmas presents, too. **Page 186**

Tractor tows away the detachable pod that is the XC-120's fuselage.

POPULAR SCIENCE

Pack Plane Drops

This may be one mission of a new come-apart

By John F. Loosbrock

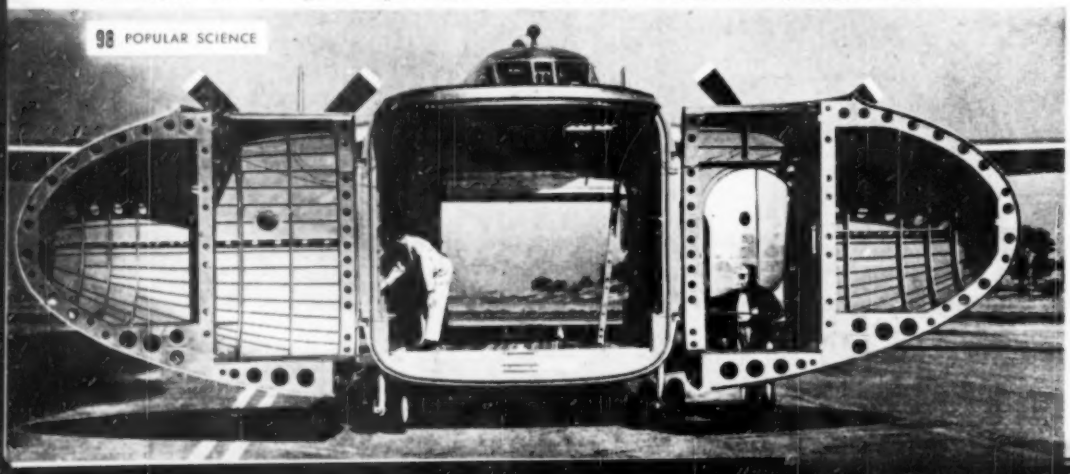
DRAWINGS BY RAY PIOCH

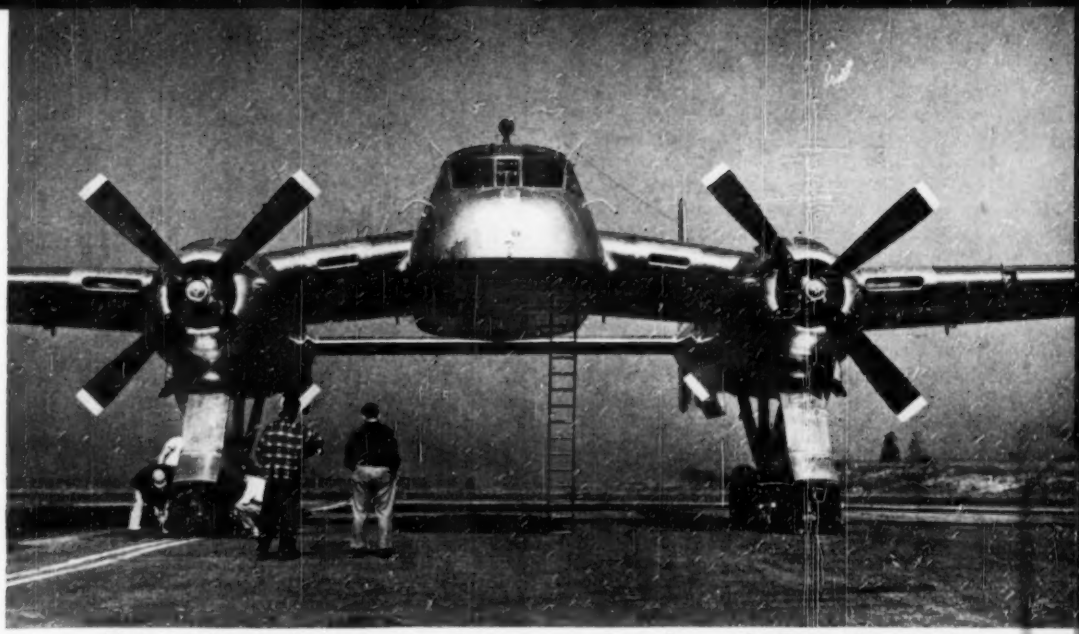
AS THE big plane waddled down the runway like a goose on stilts, gathered speed, and was airborne, I let out my breath.

I had witnessed the first trial flight of a new kind of airplane that was a preview of a whole new concept of military operations.

For behind me on the flight line sat the aircraft's fuselage, like a big trailer waiting for a pickup. And overhead, in the Maryland sky, soared the Fairchild XC-120, its long legs tucked back into the twin tail booms. A wing, a tail, a couple of engines.

Pod has clamshell doors at both ends. It can haul 20,000 lb. of cargo, or up to 64 men. Capacity is 2,700 cu. ft., empty weight 5,200 lb. Interior is rectangle for easy cargo stowage.





High, stilt-like landing gear gives clearance so pod can be towed off in either direction.

Complete Combat HQ

pod plane. It can change the whole concept of military air supply.

and a flight deck—the first airplane with a separate, complete, quick-detachable fuselage.

In this round-end boxcar, you could foresee flying or parachuting to the fighting front a complete airborne combat headquarters, field hospital, machine shop, communications center, or photographic laboratory.

The Air Force has been looking for just such a plane for a long time. So has the Army. They learned, during airborne operations of World War II and "peacetime" jobs like Operation Vittles (the Berlin airlift) that conventional planes, while able to

Air Force's new cargo plane, with detachable fuselage in place, makes first flight. Its two Pratt & Whitney engines, 3,250 hp. each, are same as those of huge B-36 Superbomber.

pack a hefty load of cargo, waste a lot of war's most precious commodity—time.

The working parts of an airplane just don't earn their keep while sitting around on the ground. Neither would a railroad engine if it had to stay on a siding with its empty freight cars. To tie up a whole plane while you load or unload ammunition, fuel, shoes, or what have you, just doesn't make sense. Or so a lot of experts think.

We use horses to pull wagons, tugs to push barges, tractors to haul trucks. So why not an airplane with a fuselage that you can unhook? Once you've got that, you can answer a lot of knotty questions.

Like flying in supplies for a fast-moving army like Patton's Third in France. Instead of a lot of C-47s flying in gas faster than it can be unloaded, build a flying gas tank, complete with pumps, and hook it on your airplane. Land, unhook it, and tow it to the nearest supply dump. It can sit there until it's needed and your airplane is already on its way back for another load. Turn-around time: that's the bottleneck in air supply. And the pod plane is designed to lick it.

Pod May Be Dropped Without Landing

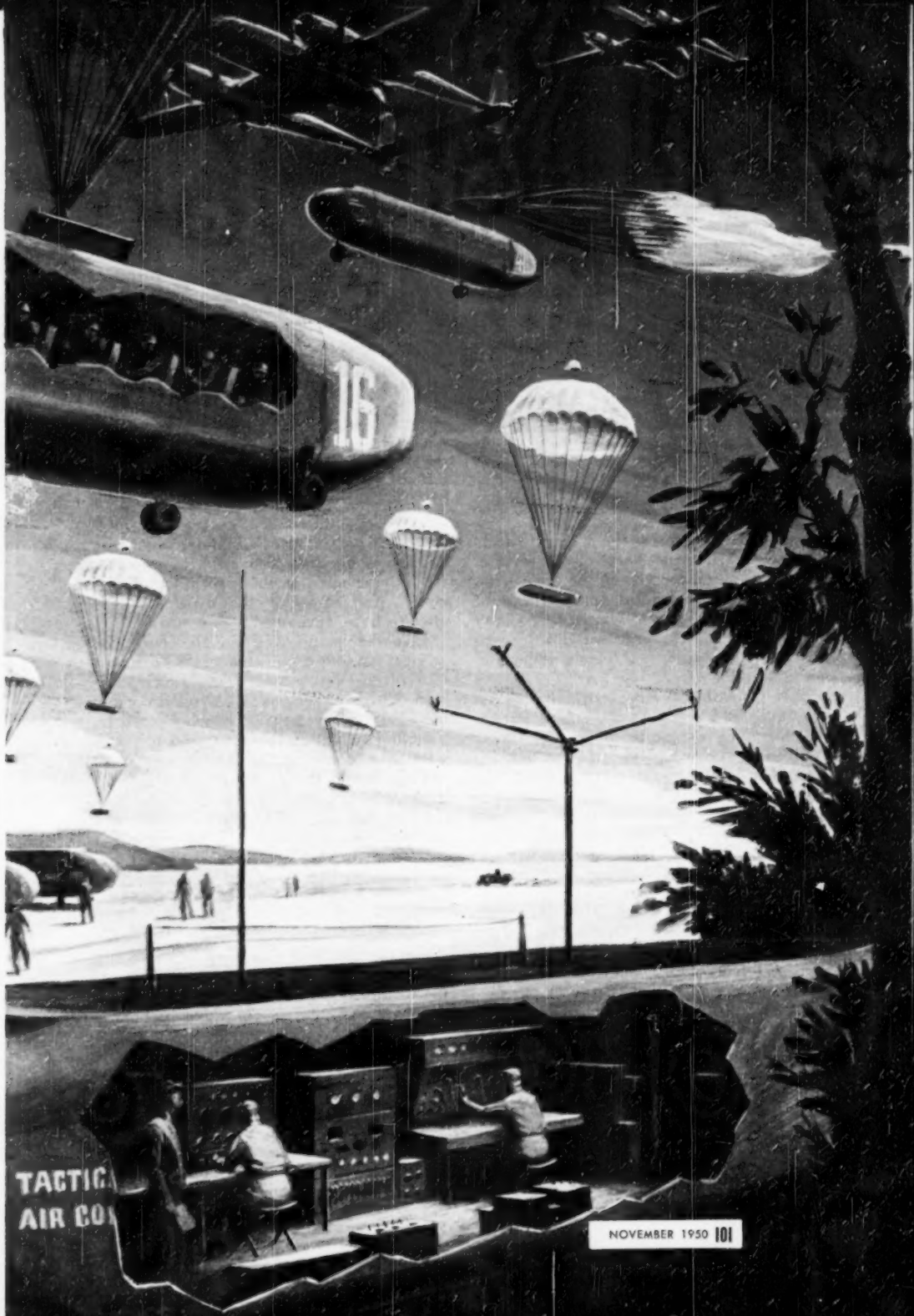
It has other advantages too. Take an air-head operation. Paratroopers have seized an airfield. More troops and supplies have to be flown in, but fast. The first thing you need is GCA (Ground Controlled Approach) equipment to guide in your supply planes.

You could factory-build your GCA setup into a pod and fly it in with the first echelon. And, as one Air Force officer put it, "Crank up your aerial and you're in business."

After the detachable pod, the next logical step is one that can be dropped without landing the airplane. Maybe the airfield is beat up or nonexistent, and you can't land. The Air Force and Army Field Forces have already dropped loads up to 10,000 pounds from a C-119 Packet. They confidently expect to boost that figure to 20,000. And they see no reason why eventually they can't just dump the whole fuselage.

Various means could be used to slow its fall, such as giant parachutes or clusters of small ones. Another proposed solution uses rockets built into the bottom of the pod. These would have proximity fuzes, set to explode at a predetermined height above

Drawing at right shows a pod-pack drop, with a communications unit already in operation.



TACTIC
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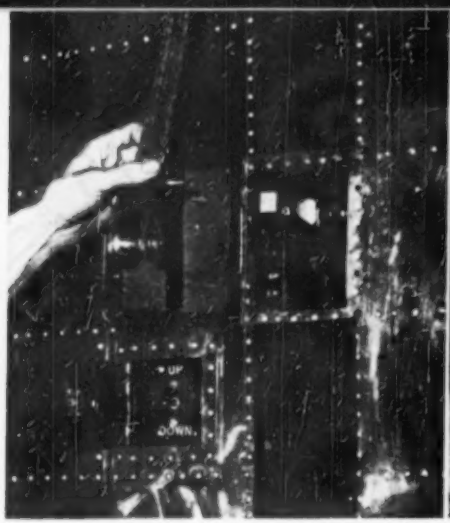
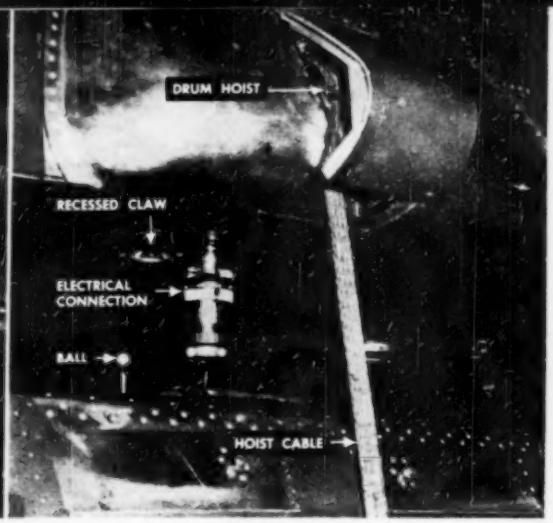


Pod is raised and lowered on flat-woven steel cables by four built-in electric drum hoists. Above, a cable end is shown being attached to one of four recessed hooks in the fuselage.



Ball-and-claw device that fastens pod to plane is shown in close-up above. Attachment between ball and cable provides electrical connection between flight deck and the cargo compartment.

the ground, to take up the landing shock. Sort of rocket-assisted take-off in reverse.

Major General Jim Gavin, the Army's top airborne expert and a longtime advocate of the pod, sees no reason why they couldn't be skidded in. He says we did it with gliders. A pod costs less than a glider and needs no pilot.

Such thinking envisages the individual parachute as already near-obsolete, except for emergency escape or some special jobs. Podfuls of men would be dropped instead. In this way we could quickly reach the Army's announced goal of making all ground units completely air transportable. With no parachute to worry about, every draftee becomes a potential airborne soldier, without special training or physical qualifications.

Variations on this theme include droppable boats for air-rescue work (PS, Sept. '48, p. 111), landing barges dropped in the sea to sneak ashore during amphibious operations, automatic radar stations for otherwise inaccessible areas. Likewise droppable navigation stations and shelters for expediting Arctic rescue work.

You may not even use a pod. Take big guns, or tanks, or trucks that are too bulky to fit into a fuselage. Just lash them to the flying platform, cocoon them with plastic for streamlining, and take off like an eagle carrying a rabbit in his talons. If you stick within the load limits of the plane you need only worry about your center of gravity.

No one I talked with, in the Air Force, in the Army, or at Fairchild, claims the XC-120 is *the* answer to the pod problem. It's a flying test bed, built to prove a principle. And some of the expected bugs already have developed.

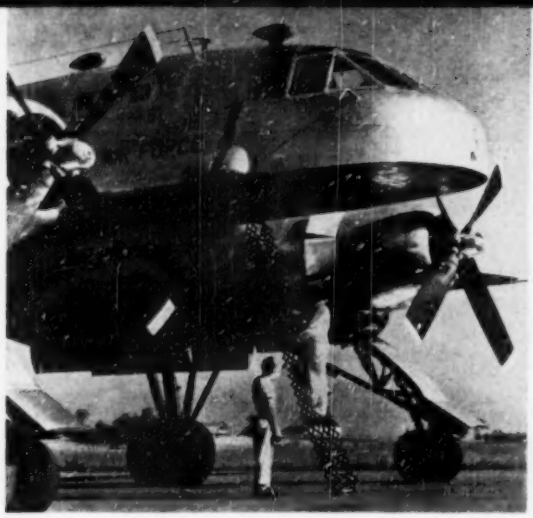
Like the quadricycle landing gear. The services wanted a pod that could be towed into place from either front or rear, also loaded from either end. This ruled out the use of the conventional nose-wheel used on Fairchild's C-82 and C-119. And it led to a lot of headaches at the Hagerstown plant.

They solved the problem with long outrigger wheels under the engines. These tuck up into the tail booms during flight. But the engineering problem was so tough that some experts wonder whether, by insisting on this capability, the services may not have lost more than they gained.

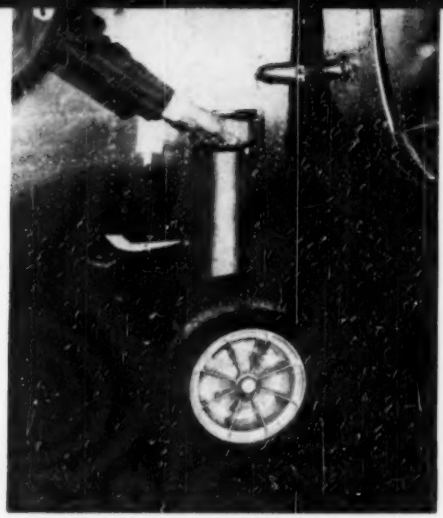
Experts Foresee Bigger Pod Planes

But experimental planes are meant to find out these things. And in flight and taxi tests the quadricycle gear is working better than expected and may even prove to be the ultimate answer. One big advantage is that in future bigger pod planes—four-engine jobs—the two outboard engines could be used to taxi the plane on and off the pod, eliminating towing.

Still other proposals incorporate the advantages of the pod with those of the tricycle gear. One solution calls for a modification of the conventional, twin-tailed C-119, the king-size Packet. The cargo section



Collapsible ladder provides access to the crew nacelle, either from the ground when pod is detached, as shown here, or from the fuselage cargo compartment when the pod is attached.



Four dual wheel units on which the pod rolls are all removable. Forward wheels have full swivel action for steering; aft pair are fixed. They can be reversed for towing from the rear.

would be cut away just aft of the nose and a pod substituted. The pod could be attached only from the rear, but most of the parts of an already existing airplane could be used, shaving production costs in terms of both time and money.

Another projected model would be identical except for turbo-prop engines to give added range and speed.

Helicopters, too, will be using pods. Piasecki is building one with a detachable fuselage, the XH-16. And Howard Hughes is working on another, the so-called "flying crane," that will move big guns, trucks, and tanks into forward positions. Air experts foresee the pod-carrying 'copter playing the role that landing craft did in relation to cargo ships during World War II.

In fact, say the pod enthusiasts, by combining the pod-carrying airplane and the helicopter the whole concept of military supply might be revolutionized. They see a sort of aerial merchant marine, using long-range pod planes to ferry supplies direct from U. S. factories. The plane drops its load at an overseas base where a super-helicopter picks it up and delivers ammo, food, or second lieutenants right to the front-line troops. Result—elimination of numerous in-between depots, transit time measured in hours instead of months, plus freedom from snorkeling subs.

Lockheed, too, has ideas about the pod. It already manufactures a small, commercial model called the Speedpak (PS, Apr. '47, p. 104) which it has enlarged and redesigned with military possibilities in view. Lockheed says it could be used as a GCA unit, a control tower, a communications center, weather station, first-aid station, or field command post.

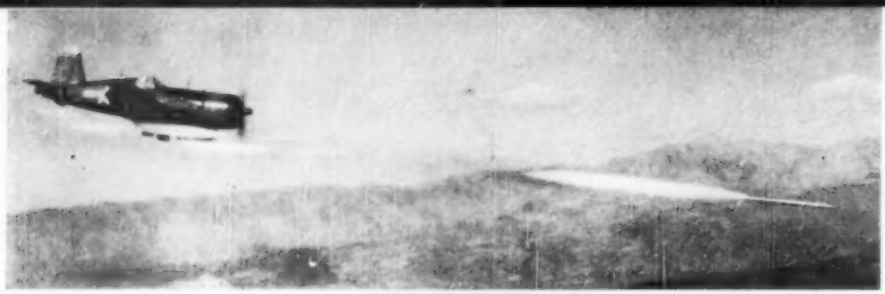
In still another proposal, Lockheed advocates modifying the Navy's huge Constitution into a pod-carrying airplane. The pod, capable of carrying 50,000 pounds of cargo, would be slung beneath the belly of the sky giant. Six of these, says the company, could supply an infantry division (roughly 16,000 men) with 53 tons of food, 104 tons of fuel, and 110 tons of ammunition each day. It could also carry heavy equipment, like two 2½-ton trucks, a 5-ton wrecker, or 18 jeeps.

Commercial Versions Are in the Picture

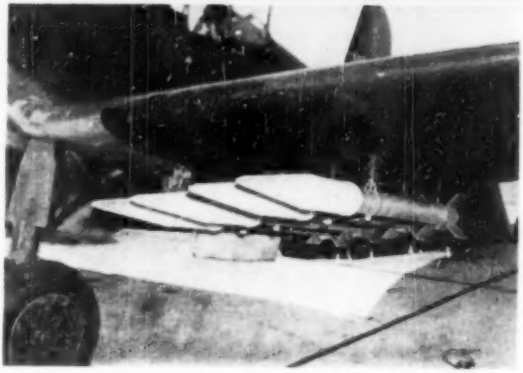
Since there are only two Constitutions and no more are planned, the proposal will probably go no further. But it does serve to show that the detachable-fuselage idea could be adapted to planes already built.

In the commercial field, the possibilities of the pod concept seem endless. Put the truck-trailer analogy to work and you come up with all sorts of ideas. Like refrigerated pods for perishable cargo, and Pullman pods that can be unhooked to let the passengers sleep till noon at their destination.

The possibilities are there, and now that the XC-120 has actually flown, the impact of the pod on aviation may not be long in being felt. END



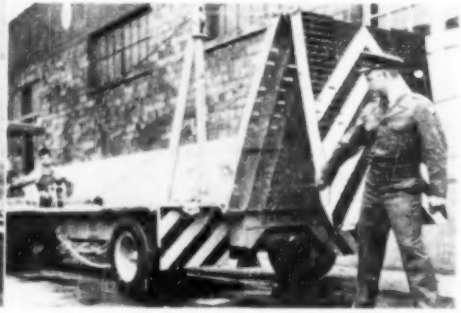
Tank-Busting Rocket



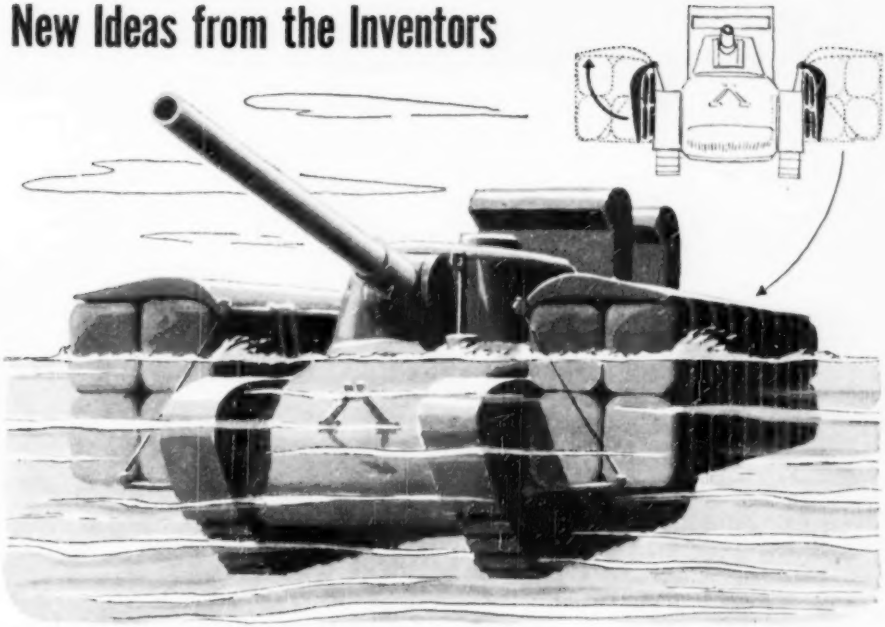
USED to blast Red tanks in Korea, this revamped HVAR Navy rocket—the "Ram"—has a new over-sized 6.5-inch, shaped-charge war head. It is said to be able to destroy any known tank in the world with a direct hit. Photo above shows the Ram being fired from a Navy F4Y Corsair fighter-bomber. Close-up at right shows how rockets are carried in racks, four under each wing. The Ram is credited with knocking out 71 North Korean tanks in a 12-day period and damaging 73 more. Part of its success is attributed to a new "blunderbuss" technique in which all eight rockets are fired simultaneously instead of singly or in pairs. They are so mounted as to converge, when fired, at a predetermined distance in front of the plane. This insures proper bunching of the missiles on the target.

Truck Drops Ramp Like Landing Craft

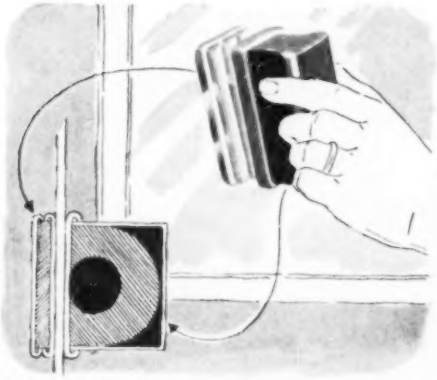
TO HAUL broken-down vehicles to the repair shop, workers at the Army's Seattle Port of Embarkation use this low-slung trailer with folding ramp. The ramp is made of steel plate and is lowered and raised by steel cables, as shown below. These run over pulleys and are fastened to a hand-operated winch at the head of the trailer. The same winch can be used to pull disabled vehicles onto the trailer bed. The rig can be operated by one man if necessary. Formerly vehicles were unloaded by crane.



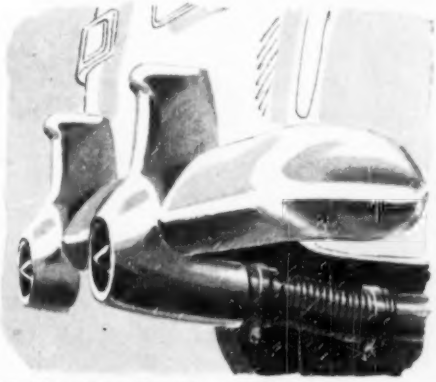
New Ideas from the Inventors



1 To Float Tanks. Fitted with this flotation gear, a tank or any heavy vehicle could ford streams and rivers. Collapsible pontoons made of rubberized-fabric cells are mounted on the sides. Covered with a hinged shield when not in use, they can be quickly inflated with engine exhaust gases. Two vertical hoodlike flues carry exhaust and air intake well above the water. Twin propellers would drive the vehicle.



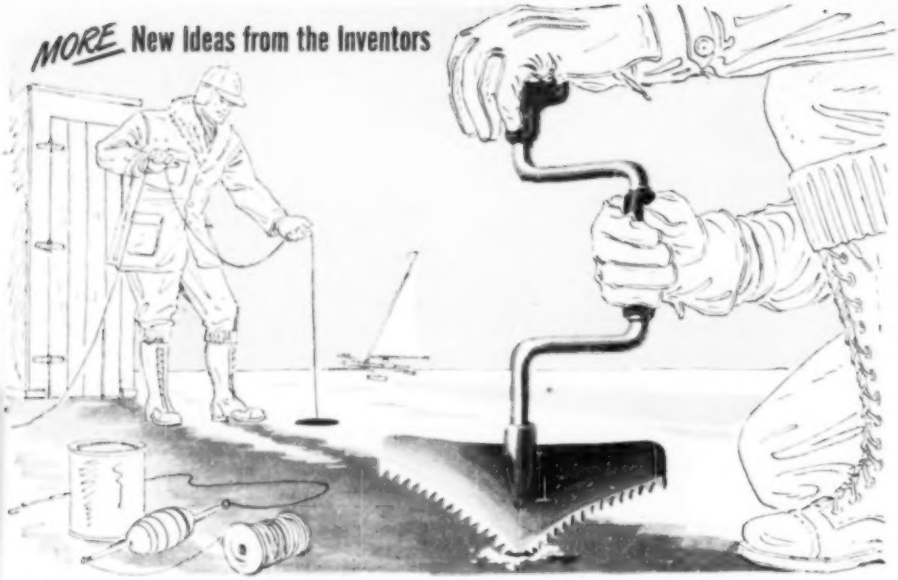
2 Magnetic Cleaner for Windows. Two pads, fitted with powerful magnets, are said to simplify the job of cleaning windows. With one pad placed outside the window and the other inside, the pull of the magnets would cause the outside pad to move with the inside pad, cleaning both inner and outer window surfaces simultaneously.



3 Guard to Double as Exhaust. An exhaust extension and bumper guard are combined in this device. The exhaust outlet, connected to the end of the regular exhaust pipe by a flexible metal hose, has a red reflector in its center and forms a decorative bumper guard. No deflector is needed to keep exhaust stains from the bumper.

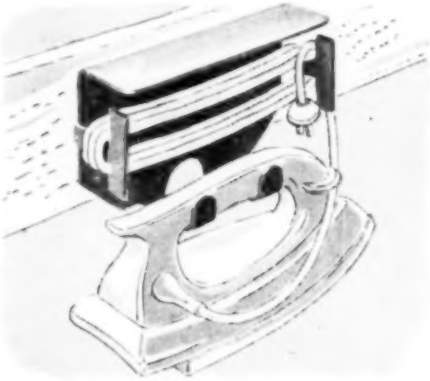
Turn the page, please, for three more new ideas.

MORE New Ideas from the Inventors



4 Auger to Cut Ice. Operated like a carpenter's brace, this auger is designed to make it easier for winter fishermen to cut circular holes through the ice. To use it, the sportsman would sink the point into the ice and rotate the handle, causing the two saw-toothed blades to cut through the ice. The chips would ride up the concave twin blades, and be thrown clear. A clean hole without floating fragments is produced.

5 Device to Deliver Air Mail. Air mail could be dropped to small communities from nonstop planes with this delivery device. A freely rotating blade would control the speed of descent, and spring mountings would protect the mail in the bag when the carrier hits and its point is driven into the ground.

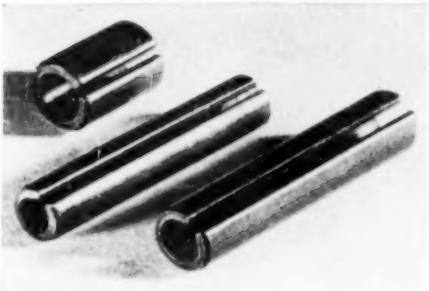


6 Rack to Hold Iron. Mounted on the wall, this metal rack solves the problem of where to store an electric iron when it is to be put away hot. Two metal hooks support the handle, while two T-shaped fingers provide a convenient means for coiling and storing the cord. The rack can be stamped out of sheet metal.

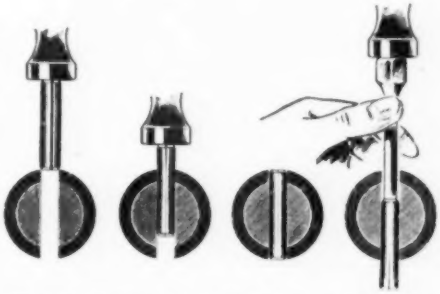
Patents on these inventions have been granted to: 1. J. Hale, J. Cox, and J. Kreyer, Akron; 2. R. D'Andrea, Long Island City, N. Y.; 3. R. Arlab, Grosse Pointe Woods, Mich.; 4. H. Coon, Highland Park, Mich.; 5. E. Bickers, Sparta, Ky.; 6. A. Morsch, Jacksonville, Fla.

Army "Miniaturizes" Switchboard

A NEW 22-pound field switchboard, less than half the weight and a third the size of earlier models, has been developed by the Signal Corps in a campaign to trim the bulk of communications equipment. The redesigned board, as easy to carry as a portable typewriter (left above), handles twelve lines, twice the number on a bigger board it replaces. Three units can be stacked together to handle 46 lines. The switchboard is resistant to moisture, vibration, and the shock of a parachute drop.



Rollpins are made in thirteen sizes, accommodate holes ranging from 5/64ths to ½ inch.



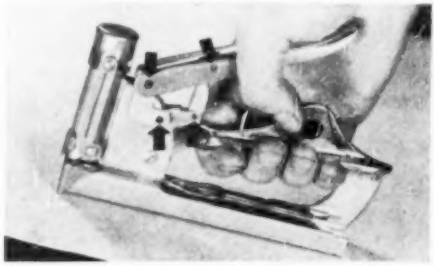
Slotted pin compresses as it enters hole. Tap of punch easily removes tension-held pin.

Slotted Pin Is New Industrial Fastener

THE simple-looking slotted cylinders above, called "Rollpins," are self-locking fasteners that may win wide industrial use in place of dowel, taper, and keyed pins.

How one holds is shown at right above. The Rollpin is driven or pressed into a slightly undersized hole, compressing the slot in the pin. The resulting permanent outward tension holds the pin secure against extreme vibration or shock. It can be removed with a punch, however, and may be re-used.

Holes can be drilled to ordinary production tolerances and still lock the pins snugly, eliminating the reaming and line-reaming steps used with conventional pins. Strength is said to exceed that of a cold-rolled pin.



Hansen tacker makes use of four Rollpins on pivot points. Fifth pin holds striker inside.

Fasteners of this kind were first developed in Germany. Rollpins are now made here by the Elastic Stop Nut Corporation.

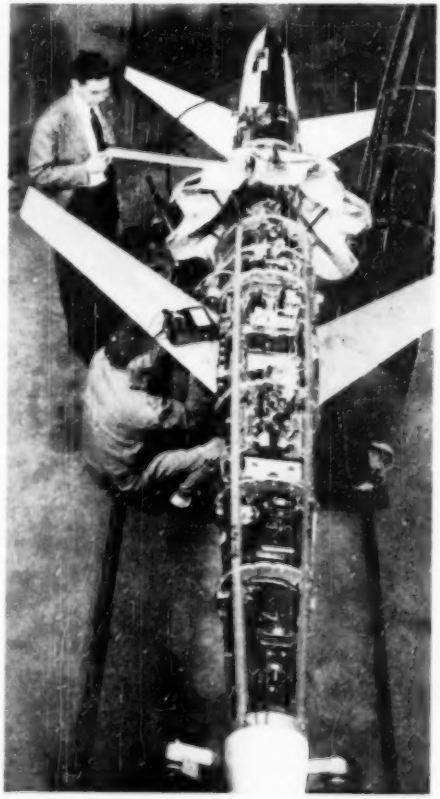
Super-Dart Drops 7 Miles To Try New Wings

Half-ton dart snuggles under belly of a two-engine plane, ready for drop to test new wings.

TO CHECK out new shapes of swept-back wings, designed for planes to fly at the critical speeds just below and above the velocity of sound, Government scientists now drop them seven miles to earth from a high-flying airplane.

In try-outs by the National Advisory Committee for Aeronautics, supplementing wind-tunnel tests, the wings are attached to a slim fuselage filled with electronic equipment that keeps tabs on their behavior during each drop. As it nears the ground, the model slows its own fall by opening an umbrella-like dive brake amidships and then popping a 36-foot ribbon parachute out of its tail. Result: the giant dart sticks its nose so gently into the soft sand of the California desert, near Edwards Air Force Base, that both the body and its delicate cargo of complex recording machines can be recovered for more drops.

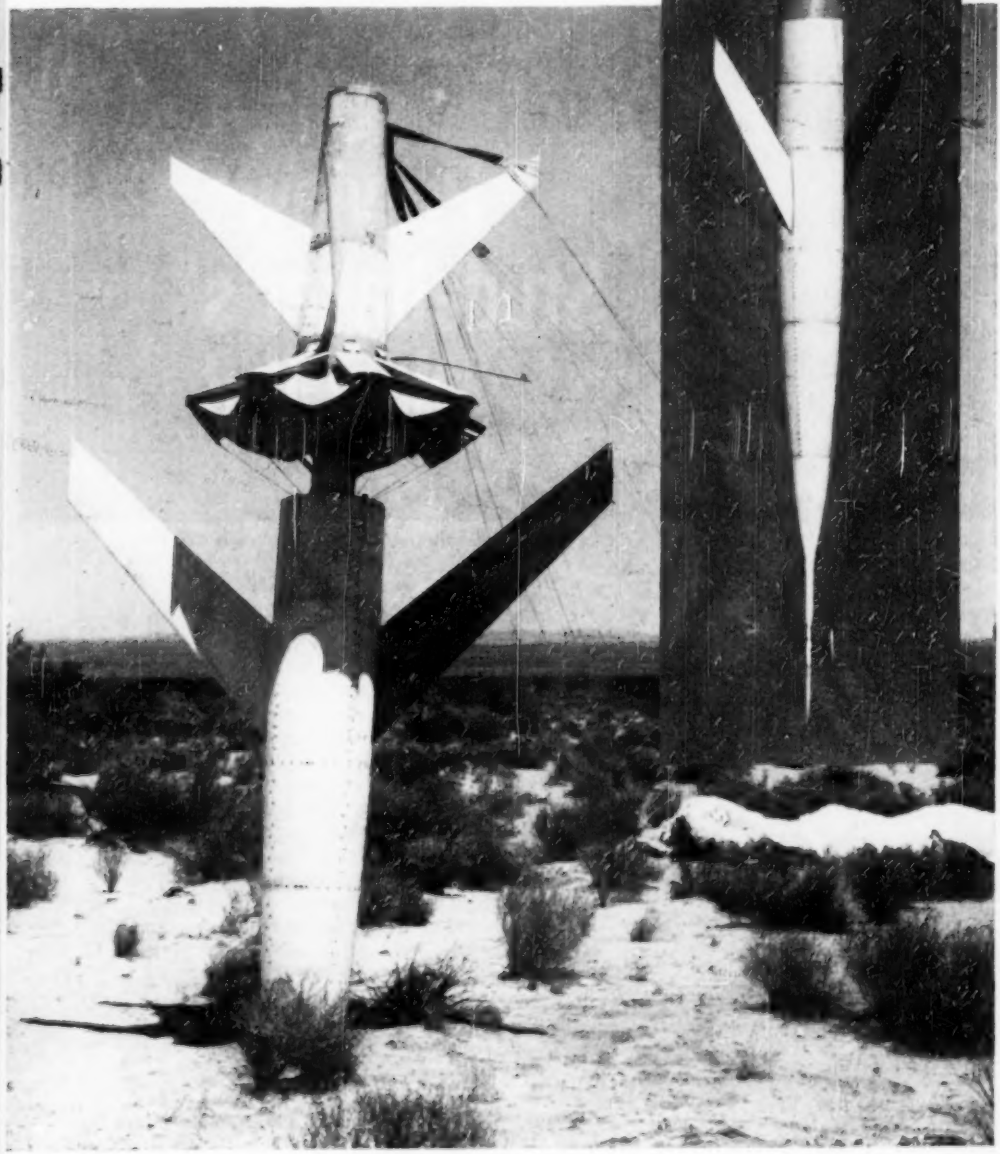
The ingenious dive brake, which can be set to open at any altitude, was developed at NACA's Ames Laboratory, Moffet Field, Calif. Similar models have been drop-tested at its other two major research centers—Langley in Virginia and Lewis in Ohio.

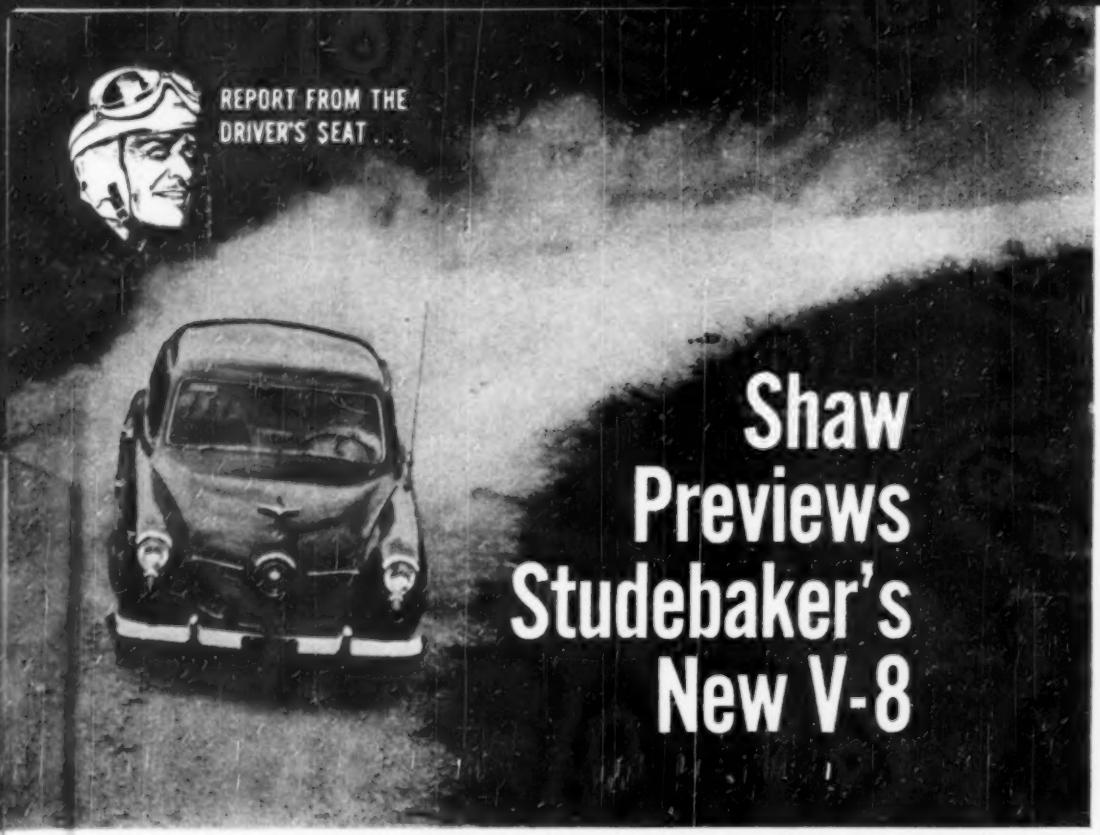


Inside of model (right) is packed with instruments that keep continuous record of wing stresses and performance during free-fall test. Speed during drop is clocked by observing model with radar and optical trackers.

Falling away from mother plane, model points its needle nose straight down at California desert some 35,000 ft. below. Swept-back wings and four-way tail become fully effective as slender model approaches speed of sound

Slowed down by parachute and umbrella-like dive brake, model buries its nose in desert sand with little damage. Brake, opened hydraulically, consists of fabric spacers between metal fingers that fold out from fuselage.





Shaw Previews Studebaker's New V-8

I gave the new V-8 Studebaker Land Cruiser the works, winding up on this twisting dirt road.

By Wilbur Shaw

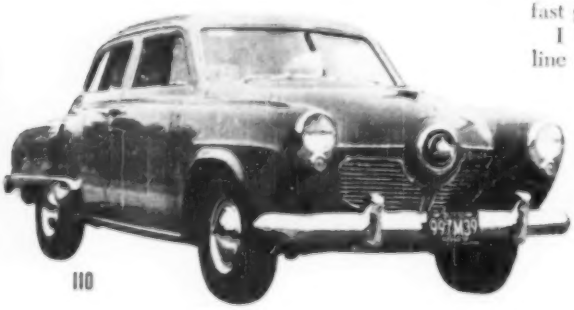
PS PHOTOS BY J. PRICE, C. TUVESON, D. DARLING

> ***EDITOR'S NOTE:*** *When one of the leading independent car makers unveils a completely new power plant, U. S. motorists want to know what it's like. Wilbur Shaw, America's best-known man behind the wheel and boss of the Indianapolis Speedway, gives the answers here.*

ONCE in a blue moon a man gets a chance to drive a brand-new engine. That's what happened to me a few weeks ago when Studebaker invited me to South Bend, Ind., to try out their V-8 for 1951, the first V-8 in their long history.

Studebaker has a name for performance. Back in 1932 five of them were entered in the Memorial Day 500-mile race at the Speedway. Two finished in the money—third and sixth. Cliff Bergere, one of the drivers, averaged better than 102 m.p.h. That was fast going in those days.

I decided that the best way to get a line on the 1951 Studebakers was to drive



Here's the 1951 Land Cruiser. It has a wheelbase of 119 in. The Commander and Champion are 4 in. shorter. The new V-8 power plants are standard in the first two, but the Champion will remain a six. The dry weight of the Land Cruiser and Commander sedans is just over a ton and a half.

the 1950 jobs first and then compare them. O. K. Butzbach, the chief test engineer at their 800-acre proving ground, arranged for it. In my book, O.K.'s initials describe the man himself.

1950 Champion. Here's the recording I made on my dictation set as I drove the 1950 Champion, smallest and lightest of the Studebaker line. Next up the scale comes the Commander and finally the Land Cruiser. The Champion was a regular gearshift job, with a standard transmission.

It's been some time since I drove a Studebaker. This springing they've got is something special. I'll have to try this on a really rough road.

I rolled on to the company's three-mile track, watching for traffic. A lot of test driving was going on, and you observe the rules or you get into trouble.

The car minds on the turns. The brakes are nice and soft. I can't get over these springs. But the steering is too slow. It is quite possible that it could get you into trouble. I'll talk about that some more. Memo: get the steering ratios.

No wind-wander. Right after the war Studebakers had that fault. Gusty side or quartering winds at high speed put you all over the road. That's been mended.

Now I went to the rough course. It's also a three-mile stretch, winding among evergreens and exploding on the goldarnest bumps you ever saw.

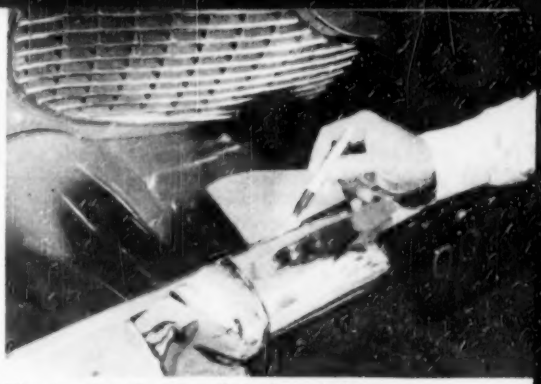
These bumps . . . how long can a car body stay together on this stuff?

I found out later. One of the proving-ground engineers told me they had tested their bodies for 50,000 miles. 60 percent of it over these bumps—and most of that at 50 m.p.h.! If they'll take that, they'll certainly stay together under what the driving public gives them.

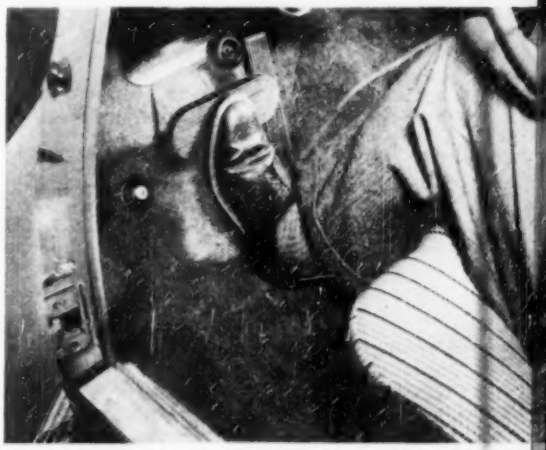
1951 Champion. I coasted the 1950 Champion to a stop on the parking area beside the track and climbed into the 1951 job. It had a gearshift too.

They haven't changed the engine. But this car has a lot more zip. That's mostly because it's lighter . . . even lighter than the 1950 car . . . I'd not say it's a flashy performer. But it wasn't designed to be. It was designed to be dependable, economical transportation. There's 21,000 . . . no, 31,000 miles on this speedometer.

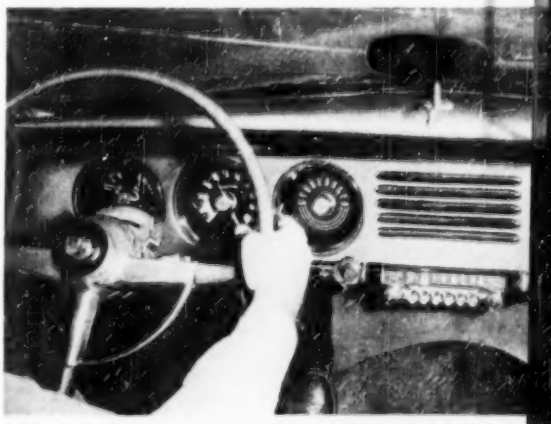
No fade on the brakes. That's quite a hump in the floor . . . covers flywheel and transmission too . . . it's the penalty you pay



The bumper bead is shaped to deflect more air into the radiator, and the grille is bigger.



That king-size brake pedal on the models with automatic transmissions puzzled me for a second. Then it dawned on me: pretty soon we'll learn to use either foot for braking, with no clutch to demand attention.



The instrument panel on the '51 Commander is neat and clean, with fingertip lever control.

for the body location in all these postwar cars. The steering's too easy. I want to feel that I'm steering.

1950 Land Cruiser. What I was really looking forward to was a spin in the 1951 Land Cruiser equipped with the Borg-Warner torque-converter transmission (PS, April '50, pp. 98 and 110). This transmission

Before I started rolling, the chief engineer at the proving ground briefed me on the rules. About midday they change the arrow and the direction of traffic. That's because carburetors and other gimmicks don't always act the same way when they get centrifugal force from one direction as they do when it comes from another. There was a car there then that was making a sustained speed run to find where rear-axle temperature leveled off at 70 m.p.h.

was designed especially for Studebaker, with the collaboration, as a matter of fact, of Studebaker engineers. But I sandwiched the 1950 Land Cruiser into the schedule at this point.

She gets away nicely. No fault to find in that department. They certainly have a sweet engine in this big six. But the front end feels pretty heavy. That may be due to bigger tires, front-end overhang, or both.

I don't understand this criticism about wind . . . some of the reports on the postwar Studebakers said there was too much wind noise . . . there isn't . . . I don't get a roar . . . whoa! Now I do! It's the vents . . . that's normal. Whenever you move air fast over a projection, it complains.

If you really want to see some fun, start yourself an argument with some engineers and mechanics. That's what I did at lunch. On my left, Charlie Cooney of Research is on his third cup of coffee, grown right on the proving grounds.

1951 Land Cruiser. Now I was set for the 1951 Land Cruiser, with the new V-8 engine. It powers both the Commander and the Land Cruiser series. Like several other automobile companies, Studebaker has gone to the V-8 to get a shorter engine and a stiffer crankshaft. With the prospect of higher compression ratios, you have to stiffen your crankshaft to prevent whip under the pounding of the pistons. All crankshafts bend. But a too-limber shaft will bend excessively. If some hot-rod owners could see what high-compression heads are doing to their crankshafts, it would give them the shakes, too.

In some ways a V-8, rather than a straight eight, is better for high compression. It lets you use a short, stiff shaft, and it doesn't call for seven or more main bearings. The

Who should I run into on the proving ground but Luther Johnson! He's driven in the Indianapolis "500" three times. Luther acts as test driver and test observer for Studebaker.

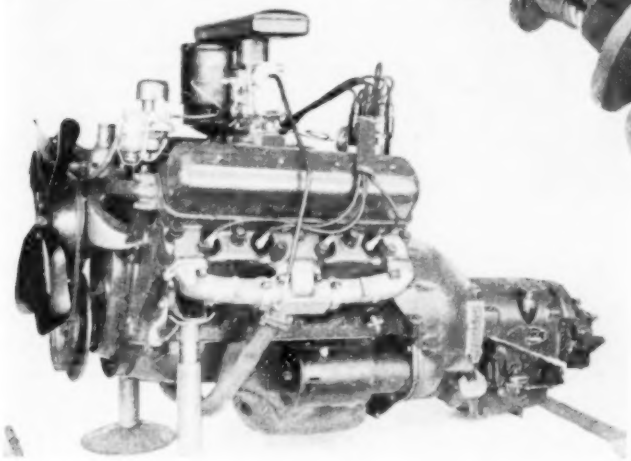
more main bearings, the more an engine costs and the more internal friction it has.

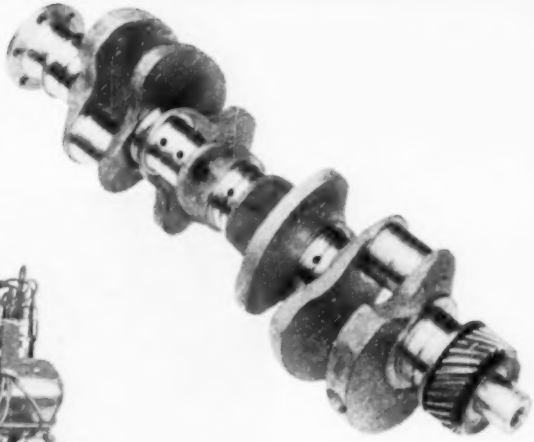
The new Studebaker V-8 is a conventional 90° job, but they have added something else—overhead valves. This isn't new, of course; both Olds and Cadillac have them. But it's new to Studebaker.

There's a reason for putting overhead valves in these postwar cars. An L-head just doesn't breathe as freely as a valve-in-head job—opinions of the L-head school to the contrary notwithstanding. As compressions go up and ignition chambers get smaller, you can't make the sucked-in gas charge and the exhaust gases turn corners and still get maximum efficiency.

Incidentally, look for two other famous

I liked this spanking new engine. She winds up to 4,000 r.p.m. and puts out 120 hp. They aren't using hydraulic valve lifters, probably to save manufacturing costs. The fan belt is one of those new thin ones.





Crankshaft of the V-8 has five main bearings and six counterweights. Diameter of the main bearings is 2½ in. and that of the crankpin bearings 2 in. Each of the crankpin bearings takes two con rods. Studebaker figures this shaft is stiff enough for any ratio.

makes of cars to come out with valve-in-head V-8's in the next year or two.

This 1951 Land Cruiser I was about to board didn't actually have an especially high compression ratio—it was only 7-to-1. Studebaker was just getting ready for tomorrow. With minor alterations this engine could be shot clear up to a ratio of 14½-to-1. That's practically astronomical, as high as our racing engines.

Well, I walked around my fourth and final mount. The lines hadn't been changed substantially from 1950. For my money the styling of the front end was improved. The car had lost its sharklike look. O. K. told me it was about the same weight as for 1950. The Commander for 1951 is 205 pounds lighter and the Champion, 55.

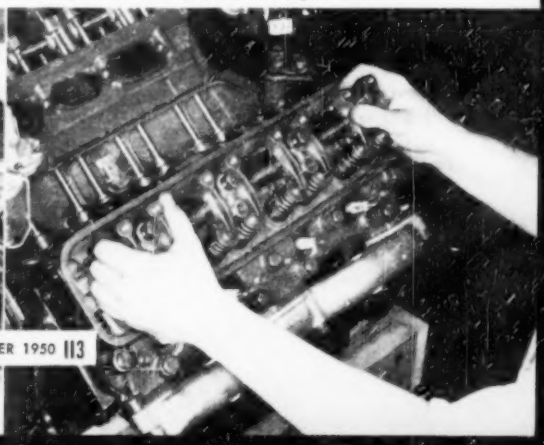
I climbed in and turned onto the track.

This has steam. The getaway is fast . . . faster than the old six . . . far faster. That's partly more power. Maybe it's partly improvements in the automatic transmission. Yet there's weight . . . you know you've got more weight in this car . . . but the ride's the same. You get the same kind of a ride . . . all these Studebakers ride the same.

One of the turns on the track was banked

O. K. Butzbach showed me how the V-8 fitted into the engine compartment. The new engine has 232.6 cubic inches piston displacement, 13 less than that of the straight six it replaces.

Mechanics will like the self-locking screw used to set valve clearance. The engine is only 20 lb. heavier than the old six, gives the same fuel mileage, and yet delivers 18 hp. more.



When they told me that the '51 cars would have an additional leaf on the rear springs. I had a look. Some joker snapped this picture.

for 100 m.p.h., the other one banked for 90.

. . . she's in the groove, on the speed button for the 90-mile turn . . . straightaway . . . next turn . . . there's not a particle of engine vibration transmitted to the chassis that I can feel. On the button in the high-speed turn. Now I'll make a fast brake to a crawl. I get the same solid, smooth, positive brake.

When you press the accelerator at a crawling speed you get a momentary murmur . . . no, that's not a murmur, it's a quiver. There's no noise. You just feel it. It's not in the engine. It may be the transmission. It may be due to the transfer of torque through the propeller shaft.

I rolled her fast on the track again, holding the accelerator on the floor to see what would happen. In this job, as in the Packard automatic transmission I drove for the September issue of POPULAR SCIENCE, you get a lockup between the engine and propeller shaft, by-passing the torque converter. The speed at which the lockup occurs depends on where the accelerator is.

She automatically cuts into direct drive at 63 m.p.h. . . . This new engine has more stuff than the old one, but maybe the casual driver won't notice it . . . You have to make too many turns on this steering wheel . . .

I found afterward that the steering ratio on the Champion was unchanged at 20-to-1 but that the ratio for the Commander and Land Cruiser was 24½-to-1. At that, the latter ratio had been dropped a half-point for 1951.

. . . you would be in a heck of a fix if a car with this steering ratio got to sun-fishing on you—got to weaving the way they do just before they go out of control. Maybe the answer to this steering problem will be a hydraulic booster . . . for the entire industry . . . with these low-pressure tires.

The emergency brake has been raised . . . that's good, it's handier . . . there's one thing about this Studebaker transmission, and give them credit for it—you can shift this selector lever all over the quadrant. On some of these torque-converter transmissions, you'd tear all the cogs out if you did that. Your kid can accidentally knock the lever of this Studebaker into reverse at 60 m.p.h. without damage.

The hood's a lot shorter. The ornament on it looks like it's right in your lap . . . that's good . . . another safety factor. This V-8 engine is 1/16 of an inch shorter than the little Champion's six. And here's a windshield . . . one-piece . . . without distortion at the outer edges. That's unique.

This is a comfortable car to drive. It really gets going when you throw out direct drive and get into the torque converter.

Easy Riding . . . and Then Some

I took the 1951 Land Cruiser to the bumps on the rough course. I'd been briefed on a change in the shocks.

This may well be the easiest-riding car I've ever driven. It's incredible . . . how it takes these bumps. The wheels stay on the ground . . . right on the ground . . . you can feel them. What bothers people in a car really are secondary vibrations. That's caused by wheel-hop. There's no wheel-hop here.

The secret of the ride is a pair of blow-off valves to relieve the pressure in the shocks, on both the bump and rebound strokes, when it gets too great. It's like a fighter back-pedaling to roll with a punch.

As I braked the Land Cruiser to a stop, O. K. Butzbach walked up.

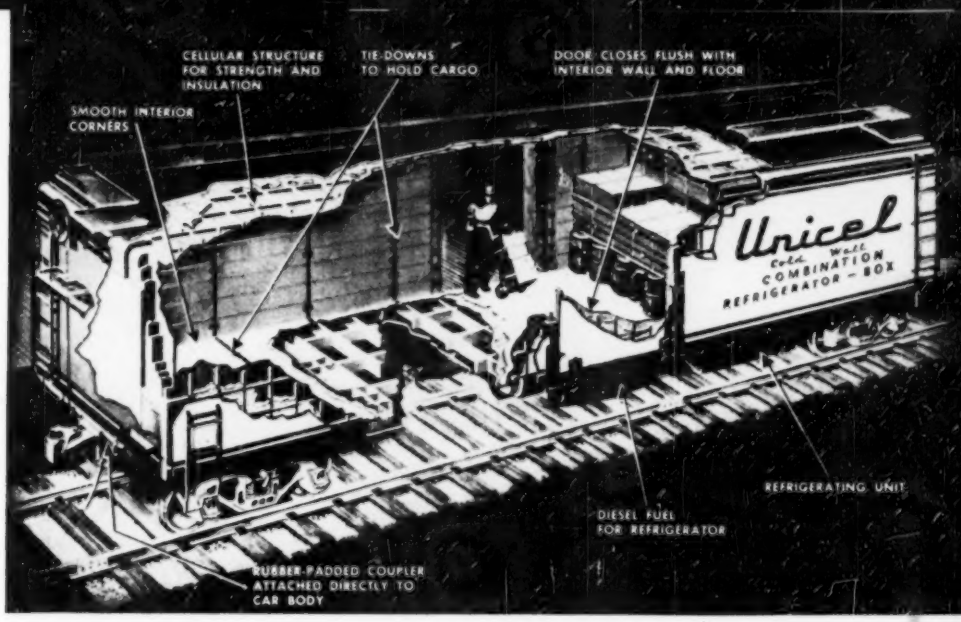
"You've got yourself an automobile in that V-8," I remarked.

He grinned. He knew it. END

This Month's Shaw-ism

Did you ever stop to think that merely letting the other guy go first would make our streets a lot safer?

Kilbourn Shaw



Plywood Boxcar Doubles as Reefer

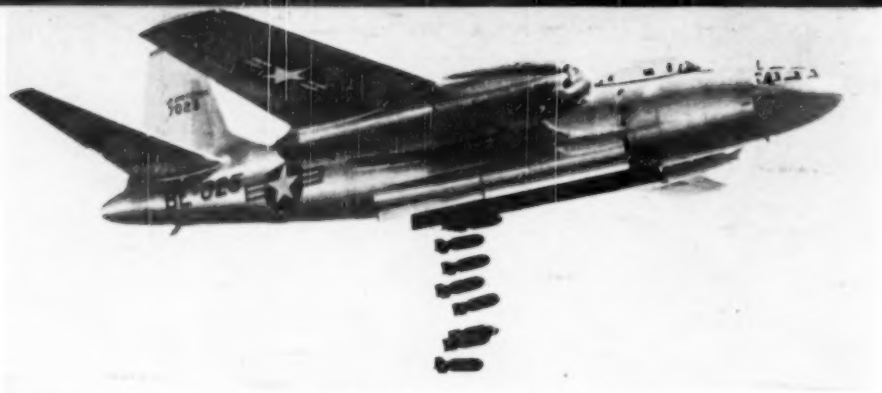
FREIGHT cars of plywood, molded into one-piece structures like PT-boat hulls and some aircraft, soon will make their debut on U. S. railroads. According to the maker, the 53-year-old Pressed Steel Car Company, the radical new design is stronger than steel. The plywood car uses 20 tons less of the critical metal than does a conventional steel freight car, carries a bigger payload when full, and weighs less when empty.

Ordinary freight cars have a steel center sill, resembling a ship's keel, to withstand stresses. In contrast, the new car distributes them through its "skin" of plywood sides and ends, electronically molded together.

First of new plywood freight cars is combination boxcar and refrigerator car, above. Drawing at top of page shows details of its interior construction and of its cooling system.

A combination boxcar and refrigerator car, first type to which the new Unicel plywood design has been applied, represents an innovation in itself. It serves the dual purpose of carrying either perishable food or ordinary cargo. As a "reefer," it employs mechanical refrigeration, unlike the conventional ice-cooled type. Its Frigidaire unit runs on Diesel power en route, and is plugged into electric outlets at sidings or warehouses. New doors and smooth, unbroken floors facilitate cargo-handling with fork-lift trucks. Its capacity as a refrigerator car is 75 percent greater than that of the ice-cooled type. When used as a boxcar it holds slightly more than a standard one. Despite its refinements, however, the new car is expected to cost less than a standard refrigerator car, and only about half again as much as an ordinary boxcar.

Other types of cars using the new plywood design are reported under development. One of these, for shipping lumber, will have 41 feet of door space on each side of a 50-foot car—something that designers of freight cars have hitherto considered an impossibility. END



Jet Bomber Drops Its Load at 500 m.p.h.

CHANGES in the bomb-bay doors to reduce air turbulence now let the B-45 Tornado, above, drop its bombs accurately at speeds of over 500 m.p.h. The new doors fold and slide upward, lessening the turbulence that sometimes made bombs tumble erratically. In recent high-speed runs the big jet bomber dropped bombs weighing 500 to 4,000 pounds each at altitudes up to 20,000 feet. Tests were made at Edwards Air Base, Calif.

Rivet Kit Handy for Home Use

THIS inexpensive home riveting kit is designed for the hobbyist or craftsman working with metals, plastics, or leather. The Rivet-Kraft kit contains an assortment of 3/32- and 1/8-inch semi-tubular rivets, washers, and two rivet clinchers of hardened steel. It's priced at $1.50 by Lloyd's Craftlines, of Burbank, Calif.

Mosaic Made of Wood Veneer

AT WORK in the basement of his home, Fritz Bade, a Louisville businessman-artist, inserts another wood-veneer piece into his nearly completed jigsaw mural. The mosaic—a tobacco-auction scene—is four feet high by six feet wide. One of four depicting local trading customs, it will decorate the walls of a Louisville bank.

Kids' Tractor Does Real Jobs

HERE'S a midget tractor Tom Sawyer would have appreciated: neighborhood kids will fight to mow the lawn with it. Weighing only 154 pounds and powered by a 2-hp. engine, the Bantam Tractor easily pulls a 600-pound trailer load. Simple controls and protected belts allow a child to operate it safely. Its top speed is 4½ m.p.h. Made by Standard Mfg. and Sales Co. Lebanon, Ind.

What Kind of Tanks Do We Need?

Here's the best tank we have, the M-46 General Patton. It weighs 47½ tons, has 90-mm. gun.

Early Red armored successes in Korea changed some Army thinking, but our best tanks are still made of paper.

By John F. Loosbrock

PS PHOTOS BY W. W. MORRIS

EVER since the Public Proving Ground for Weapons opened in Korea, people have been asking, "What happened to our tanks?"

The tough Soviet-built T-34* mediums played too rough for our M-24* reconnaissance jobs. The Red tank pitted an 85-mm. gun and 38 tons against our 75-mm. gun and 20 tons.

Our M-24s were the first to fight, simply because they were handy. Supposedly they were picked for occupation duty in Japan

** The Russians say "T" for tank. We say "M" for model, "T" for test.*

New wobble stick lets you steer tank like an airplane. Pulling stick straight back takes you from neutral, through low and high, into reverse. Push the stick to right or left for turns.

Protective grating over engine is sectional, so it can be easily opened by one man. Grating is beefed up with slits slanted at an angle, to protect the engine from damage by strafing planes.

because anything heavier would be too much for flimsy Jap roads and bridges. They were boys sent to do a man's job.

Our first man-sized tank on the scene was the General Pershing—biggest and most potent of our World War II armor. This M-26 weighs 45 tons, mounts a 90-mm. gun, and has a top speed of 25 m.p.h. Next in action was the M-46—the General Patton—our only operational postwar tank. Hard to tell at a glance from the Pershing, the Patton also sports a 90-mm. gun, weighs 2½ tons more, and has a top speed of 30 m.p.h. Actually, the Patton is a vastly better tank, for reasons that you will see.

Shadow of Joseph Stalin III

But behind the Reds' T-34s is the shadow of the Russians' even bigger and heavier tank—the Joseph Stalin III. This 57-ton low-slung, crawling fortress has a 122-mm. gun in a sloping turret that's hard to hit squarely from any angle.

The vague worry of the public, and the real problem of the tank experts, is how to handle such monsters as the JS III. For the kind of tanks we need is dictated by more considerations than the obvious answer—"something that can stand up and slug it out with a Stalin toe-to-toe."

For one thing there are differences in the ways tanks are used. Some act as cavalry, to locate and probe enemy lines. Some are used to punch holes in the line through which the doughfoots can advance. Sometimes they do have to stand up to enemy tanks and slug it out.

In view of these diversified missions, the U.S. Army doesn't believe in an all-purpose, universal tank. It wants a light one for recon work, a medium for infantry support, and some heavies to stop the enemy's heavy tanks and to act as mobile assault guns.

The Russians don't believe in an all-purpose tank either. But they stick to mediums and heavies; no lights. This points up a basic difference in tactics. The Russians like a head-on assault. We like to combine our frontal attacks with slashing sweeps around the flanks. To do this we need tanks that will get out and go.

Another basic reason why we can't use as heavy, or as many, tanks as the Russians is a simple exercise in logistics. We have to ship our tanks thousands of miles across salt water and feed them with fuel and ammo when they get there. The Reds can ship by flatcar or drive over roads. And their ammo and fuel-supply problem is comparably easier.

Now, once you know what a tank has to do, you must wrestle with a triple-horned dilemma—the best compromise between the conflicting demands of (1) firepower, (2) mobility, and (3) protection. The best combination boils down to a matter of judgment—considering such factors as American soldier psychology, our economic resources, and tactics (both ours and the enemy's).

And here's where our designers have done a flip-flop. We used to give top priority to mobility and speed, probably as a result of what some call the Detroit influence on American ordnance. We would build the most agile tank we could, within weight limitations, and *then* hang on it the best gun it could carry. Usually this was an already existing artillery or antiaircraft gun.

The result was that our World War II Shermans, while they could outrun and outmaneuver anything the Germans pitted against them, were woefully deficient in firepower. We made up the difference in numbers, figuring that three speedy tanks could outfeint and trap a clumsier, though more potent, Tiger or Panther.

Now the pendulum has swung in the opposite direction. We've adapted an old naval concept to land warfare. Take the gun you need for the job, then build a tank to handle it. We make our compromise among the three horns of the dilemma by putting firepower first, followed by mobility and protection in that order.

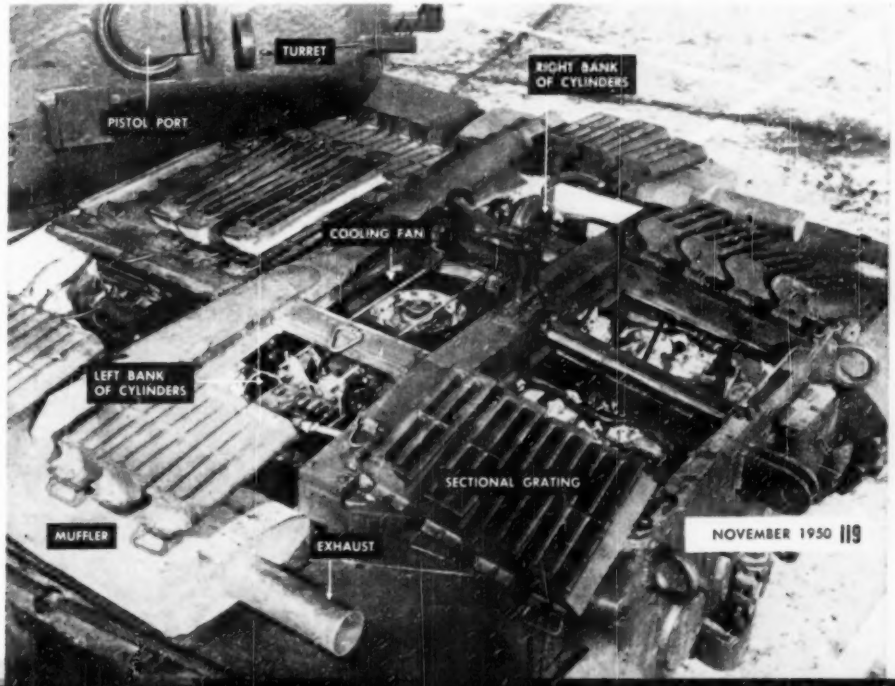
And this brings up more compromise. Hole-punching hits require bigger guns, and heavier, higher-velocity ammo. But the ability of crews to handle big stuff in a sardine-can turret is only one restriction on size. So you have to strike another balance between size of gun, ease of loading, ammo-carrying capacity, low silhouette, and so on.

Getting the First Hit

That first-round hit is important. To get it the Ordnance Department is working on an automatic ammo loader and a built-in rangefinder. Guns will be power-operated and stabilized for accurate fire when the tank is in motion.

Another factor influencing size and weight of tanks is the growing emphasis on antitank weapons, particularly those like the bazooka

Behind the Patton's bulky turret nestles its new air-cooled, 810-hp. engine, lighter but turning out more power per pound than its liquid-cooled predecessors. Photo shows one of two powerful fans that suck cooling air through heavy grating. The engine is built by Continental, is a 12-cylinder V-type, with dual mufflers and exhausts on exterior of tank.



Differences and similarities of Pershing and Patton tanks are revealed by this and the facing photo. Pershing, above, is underpowered for its 45-ton weight, with a 500-hp., liquid-cooled engine against the Patton's 810-hp, air-cooled job. Pershing also lacks Dynaflow transmission and the wobble-stick steering feature, hence is much less maneuverable than the Patton.

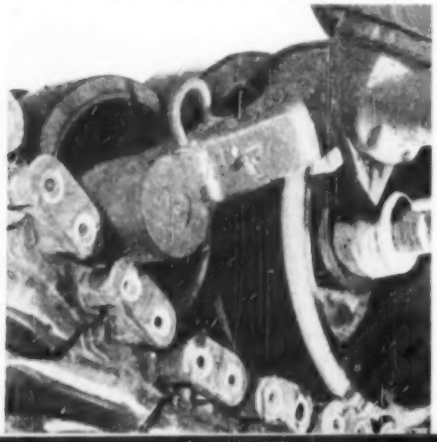
and the recoilless cannon. Of course, due to the disparity in effective ranges of a bazooka and a tank's gun, a tank is still the best anti-tank weapon. But even during World War II only 20 percent of the ammo fired by tanks was fired at other tanks. The other 80 percent was fired at troops and fortifications.

There is one school of thought in the Army that holds that it is useless to try to counteract the increasing potency of AT weapons with more armor. Your tanks get sluggish and road-bound. So—by this reasoning—the tank, like the infantryman, must learn to avoid the hit rather than to absorb it, and it must improve its killing ability. It must do what the foot soldier did when gunpowder threatened to make him obsolete. He discarded his body armor altogether and compensated for it with cover, mobility, and firepower.

Our tank designers haven't reached this point yet. But the fact that we are more and more inclined to sacrifice protection for firepower and mobility may mark a trend.

These are some of the things we want on our new tanks. But how close are we to getting them? Not very close. The best tank we have is the Patton. It's a sort of half-breed, old on the outside, new on the inside, with many of the same internal features that our still-on-paper new jobs will have.

Like all of our new tanks and many of our experimental trucks, the Patton tank has a torsion-bar suspension system. Bar twists to take up shocks as bogies roll over obstacles.



Liquid Cooling on Way Out

For one thing, the Patton has an 810-hp, air-cooled engine, compared with the Pershing's 500-hp., water-cooled power plant. This engine is one of a whole family of air-cooled jobs to which the Army is converting as rapidly as it can. It can operate equally well in the hottest desert or the coldest Arctic waste. And it turns out more power in less space, since the cumbersome liquid-cooling system is eliminated.

Also new is the transmission and steering systems. Gone are the old dual levers with which you braked one track at a time to make a turn—and burned out the clutches if you turned too sharply.

Resemblances between Patton (above) and Pershing are many, as these photos strikingly show. Main exterior difference is the Patton's new, improved 90-mm. gun with higher muzzle velocity than the same size gun mounted by the Pershing. Muzzle brake, which inhibits recoil, is single-baffle type, found to be just as efficient as double-baffle type on the Pershing.

Instead there's a "wobble stick," roughly similar in operation to the airplane joystick. All the way forward is neutral. Pull the stick back one notch and you're in low. Another notch to the rear and you're in high. All the way back is reverse. There's no clutching. And in any gear you steer merely by pushing the stick to the right or left. The steering is hydraulically aided, with no brawn necessary.

The savings in driver-training time and driver fatigue are immense. I found this out when I climbed into a Patton and tooled it over Aberdeen Proving Ground's Munson Test Course with nothing more than some shouted instructions from a lieutenant in the assistant driver's seat. It was actually easier than it would have been to learn from scratch to drive a passenger car.

Transmission Is Buick's Big Brother

The transmission is a hydraulic torque converter, quite similar to Dynaflow. This is combined with another feature called "cross-drive." Using it, you make one sprocket drive forward while the other turns backward. The tank promptly turns in its own length.

The Patton's gun is the same size—90-mm.—as the Pershing's. But it's heavier and harder hitting, with a higher muzzle velocity than its predecessor. Ammo is improved, including the shaped-charge shell (PS, Oct. '50, p. 98). Even newer armor-piercing projectiles are in the mill, indicating that the Army isn't putting all its eggs in the Munroe-effect basket. One of these new projectiles is known as the squash-head shell. It has a soft explosive head that flattens out against the target, taking advantage of an effect called "spalling." The projectile doesn't penetrate the armor but causes it to flake away inside into lethal chips of metal. And there are other innovations in the ammunition field that are even more radical.

But the Patton, although it's a good tank and the best we have for the moment, is already obsolescent. At best it's merely a radi-

Trademark of the new air-cooled tank engines is the exterior muffler and exhaust, one for each bank of cylinders. Drawback is they glow cherry red when hot, making a good night target.

cal modification of a World War II tank. To fill the chinks in our armor, the Army has announced a whole new family of tanks that has been frozen into prototypes and scheduled for mass production.

New Light Tank in the Works

Details are still heavily swathed in security restrictions. But we do know some facts and can guess more. We know the new tanks will come in the three desired sizes—light, medium, and heavy. Of these only the light T-41 is ready for mass manufacture. Cadillac will build them for the Army under a recently negotiated contract.

The T-41 weighs 25 tons and is heavily armed (a 76-mm. gun) for its size. It is powered by one of the new air-cooled engines. With this beefed-up armament, it should be a top-notch reconnaissance tank.

All we hear about the medium and heavy is that the medium will pack a larger gun than it did before. It's a likely guess that weights will run around 45 tons for the medium and 50 to 60 tons for the heavy. Although we have never been crazy about heavy tanks, we need something to stop the JS III and a tank is still the best antitank weapon we have.

Guns on the new tanks will be lighter but will fire at higher velocities, about a 30 percent across-the-board improvement over World War II guns. The new ammunition designs may double this figure. Size for size, says the Army, our new guns will be the finest in the world, thanks to American metallurgical and chemical know-how. Armor will be tougher, stronger, but lighter. And the new jobs will have all of the improvements in engines, transmission, and steering now incorporated into the Patton.

But it will be several months before the first of these new models rolls off a production line. And if the Patton can do the job until then, we should be in pretty good shape tank-wise.

As to how good our present and future tanks are, the Army says this: The Pershing and Patton are more than a match for the Red T-34. And they "can penetrate the JS III over most of its surface." This probably means anywhere except head-on or on the turret.

New Heavy Will Lick Red's Best

Further, says the Army, the forthcoming T-41 should also be able to whip the heavier T-34. Our new medium will be immensely better than the Patton. And our new heavy, with big new guns now under development, should be able to handle the JS III anywhere, any time—and any practical improvement of it.

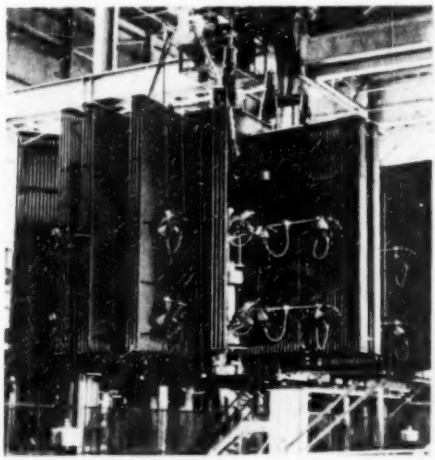
Trouble is, you can't throw a blueprint at a tank—and the Russians are estimated to have a stockpile of from 40,000 to 50,000 T-34s and JS IIIs. The truth is that we were caught with our armor-plated breeches down and can only hope we'll be given enough time to remedy the situation. END

Russia's best—the massive Joseph Stalin III rolls down a Moscow street during a Red parade. It weighs 57 tons, packs a 122-mm. gun. Note the low, sloping turret that's hard to hit straight on.

New British Fighter Plane Has Contra-Props

To get the last ounce of pull out of its engine, this new British naval fighter, called the Mark II Wyvan, uses contra-rotating propellers. Equally impressive is its armament—16 rockets, each with a 60-pound war head, a torpedo, and guns.

The Wyvan was one of 58 new military planes displayed at the Farnborough experimental base in England recently by the Society of British Aircraft Constructors. Only experts of the Western European nations were invited. The Russians were not.



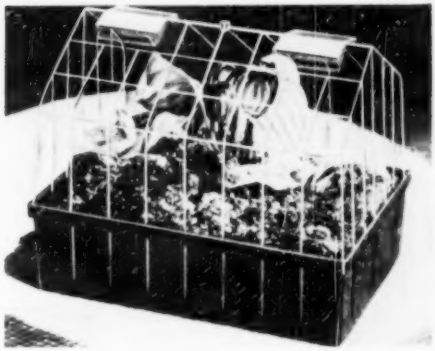
Transformer Is Big as House

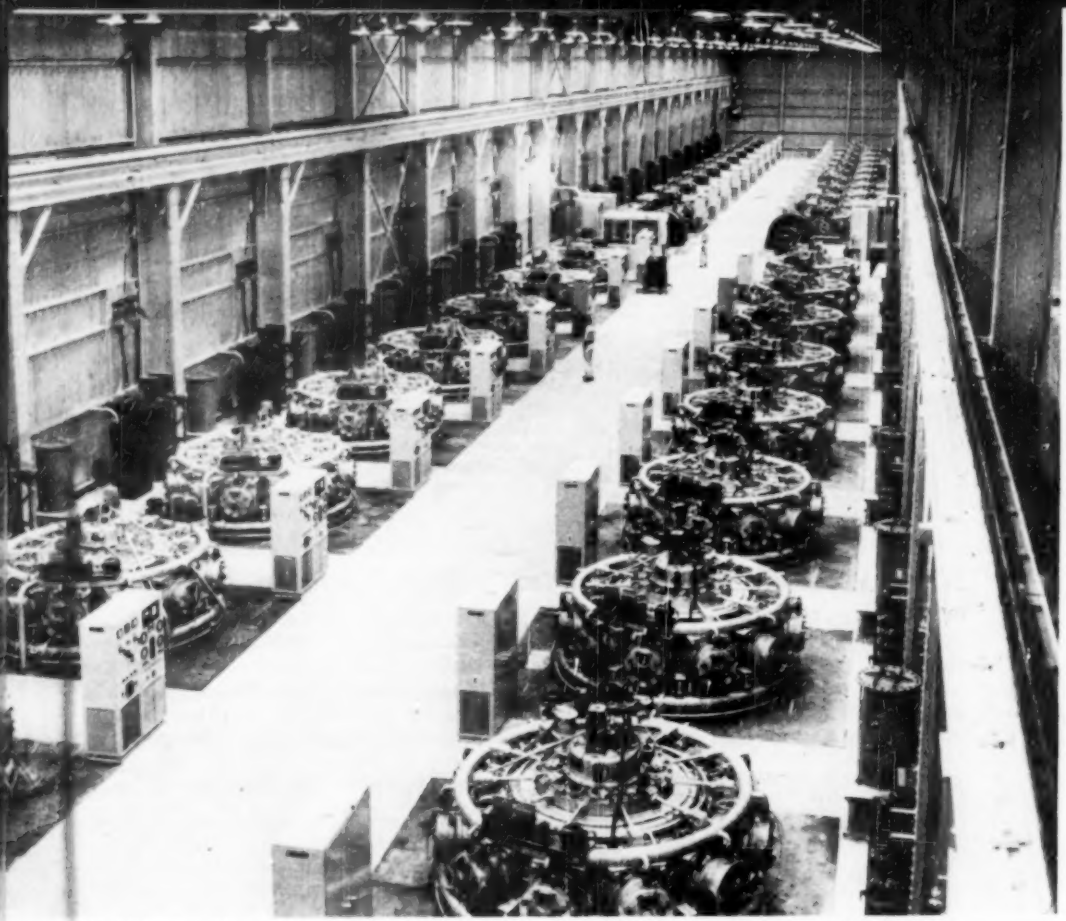
This transformer, biggest ever built by the General Electric Co., is almost the size of a five-room house. It is shown at left being hoisted from a test pit of the GE Transformer and Allied Product Divisions plant at Pittsfield, Mass.

It is designed to operate at voltages as high as 138,000, and is fan-cooled. The first of four units being built for an electric power company in Missouri, it had to be shipped on a special drop-frame car—one of three such cars in the U. S.

Hothouse Made of Plastic

A miniature hothouse retailing for less than $1 is now on the market for the growing of sensitive, small plants needing special care. Ventilation is afforded by louver-type dormer openings in the roof. Made by the Bernard Edward Co., Chicago, the all-plastic Beco Hot House is 7¾ by 5¾ by 6 inches.





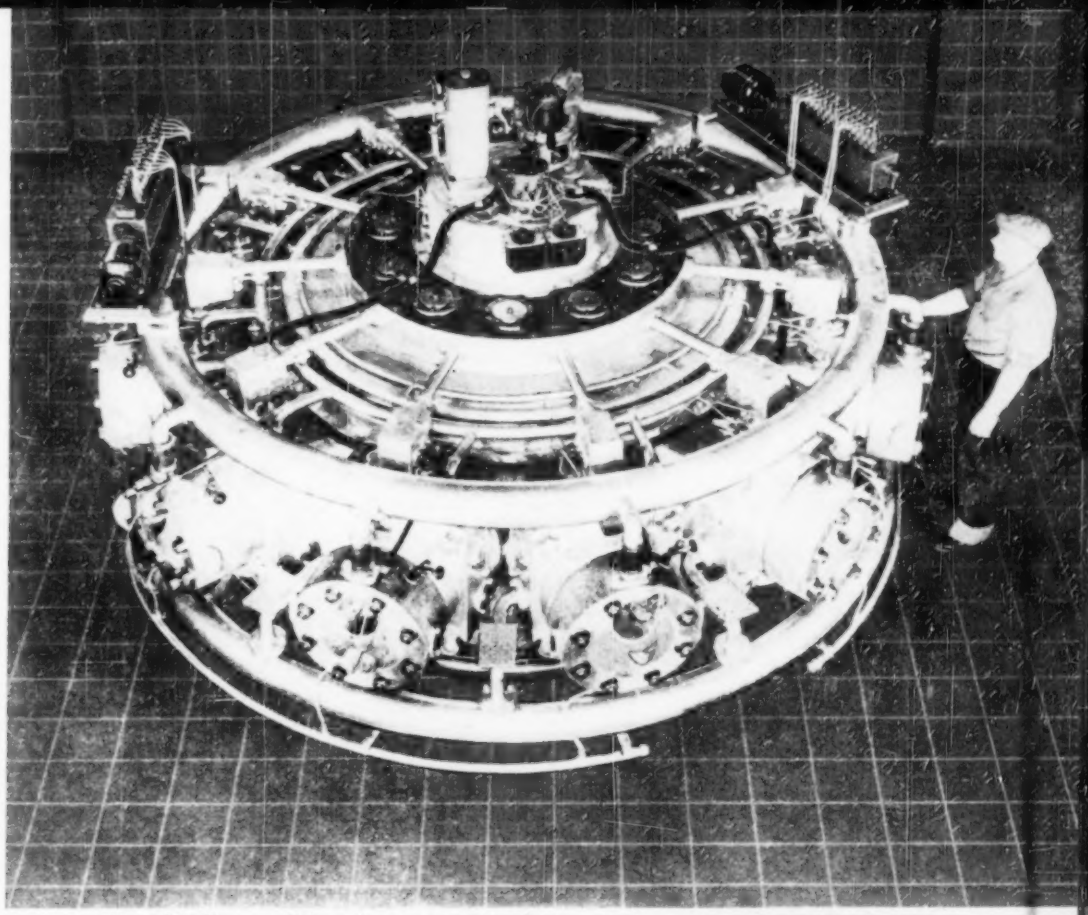
Mighty generating plant at Point Comfort, Texas, uses 120 of new stationary radial engines.

Giant Radial Engines Run a Power Station

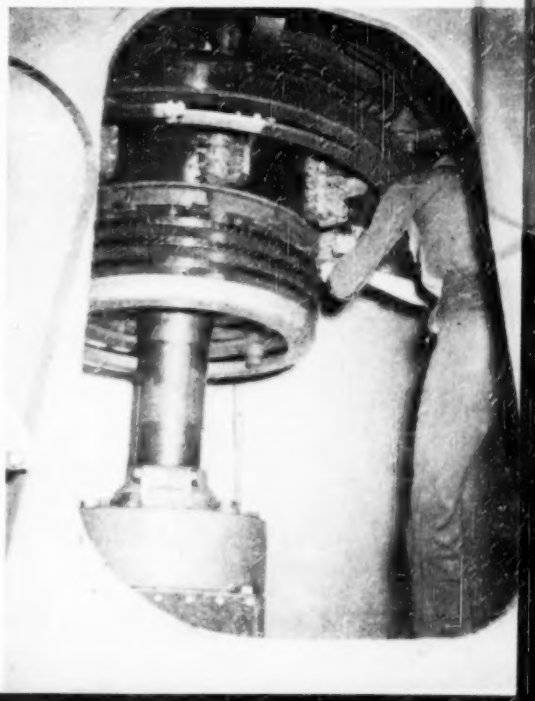
By Alden P. Armagnac

TO MOST people, radial engines are the things that spin airplane propellers. But in a new Aluminum Company of America plant at Point Comfort, Texas, 120 giant radial engines are turning the wheels of a great power station. Running on low-cost natural gas, each engine drives a 1,000-kilowatt generator, yielding direct current for extracting pure aluminum from an electrolytic bath. The process consumes so much current that it has hitherto required such plants to be located near cheap hydroelectric power.

A stationary prime mover of radical new design, called the Nordberg radial engine, thus makes its debut. It is as well suited to small installations as to large ones. A power cooperative at Milaca, Minn., has already in-



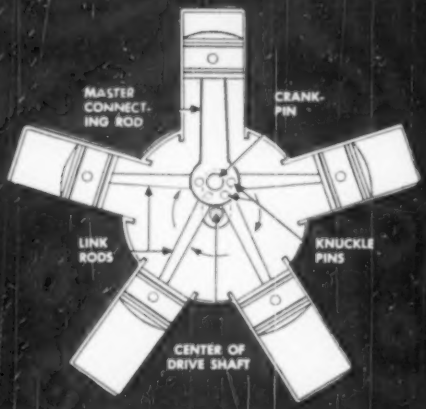
Giant Nordberg radial engine runs on natural gas or Diesel fuel. It develops 1,800 hp. at 400 r.p.m. Engine above, one of installation on opposite page, is equipped to burn gas. It drives a 1,000-kw. direct-current generator (right), installed on floor below engine room.



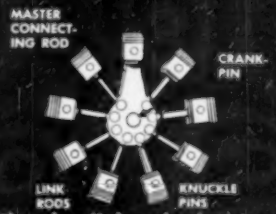
stalled two Nordberg engines, and you may expect to hear more of them.

Developed especially for generating power by the Nordberg Manufacturing Company of Milwaukee, the new engine has a radial design for compactness. An engine and generator together need only 12 by 12 feet of floor space and 18 feet of headroom.

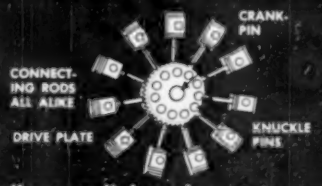
The eleven-cylinder, two-cycle Nordberg engine uses aluminum-alloy pistons as big as buckets. It has a 14-inch bore and a 16-inch stroke. At its normal operating speed, 400 r.p.m., it develops 1,800 hp. With only slight alterations, it operates as a spark-ignited natural-gas engine, as an oil-burning



How a radial engine works is shown in diagram of a simple, conventional one of airplane type, above. As each cylinder fires, kick of its piston is transmitted through a linkage of rods to crankpin. Successive kicks drive crankpin, in orbit indicated by arrows, around center line of drive shaft that it turns. A single-row radial engine has an odd number of cylinders, usually ranging from five to nine. Because its cylinders are in same plane, all of their pistons' connecting rods have to be attached in some manner—either directly or indirectly—to the same crankpin bearing. This drawing and the upper one at right show standard way of doing it.



Conventional radial engine has piston-and-rod assembly above. End of master connecting rod from one piston, encircling crankpin, forms steady drive plate that will not rotate on own axis. Link rods join other pistons to it. Disadvantages of design are side thrust on master-rod piston, and vibration due to lack of symmetry. Knuckle pins move in distorted ellipses of various shapes and sizes.



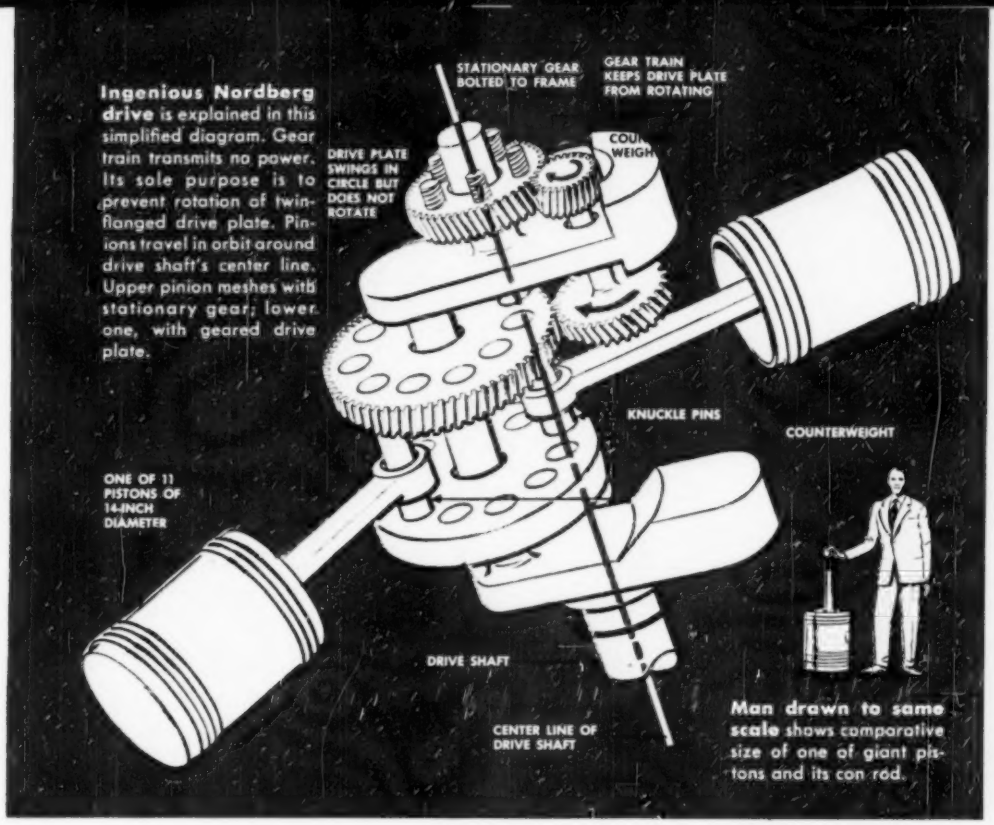
Nordberg radial engine attains symmetrical design, minimizing vibration and wear, through use of a separate drive plate to which all pistons are linked. All connecting rods are exactly alike. Knuckle pins move in equal and perfect circles, assuring balance. How designers have solved problem of keeping drive plate from rotating on own axis, as it swings with crankpin, is shown at right.

Actual appearance of Nordberg drive is shown in this photo. Diagram on next page reveals how it works. (For clarity, drawing is not to scale.) While drive was developed for heavy and relatively slow-speed stationary engine, makers believe it would have same advantages, in principle, for radial airplane engines.

Diesel, or as a combination oil-and-natural-gas Diesel. Compressed air starts it.

To minimize vibration and cylinder wear, the Nordberg engine introduces a patented drive that deserves a place in any science-museum exhibit of ingenious mechanical motions. Dispensing with the master connecting rod of conventional radial engines, a novel linkage yields a perfectly symmetrical and balanced design.

Connecting rods of the Nordberg drive are all alike. They are attached to a central drive plate, which transmits energy to the crankpin and travels with it in a circular orbit. Gear teeth, rimming one of the drive plate's twin flanges, meanwhile engage a gear train ending in a stationary gear bolted to the engine frame. The gear train transmits no power, and has only one purpose: to hold the drive plate in correct position, with respect to the pistons, by keeping it from rotating on its own axis while it swings in a circle. For this puzzling mechanical problem, a novel and positive solution has been found. END

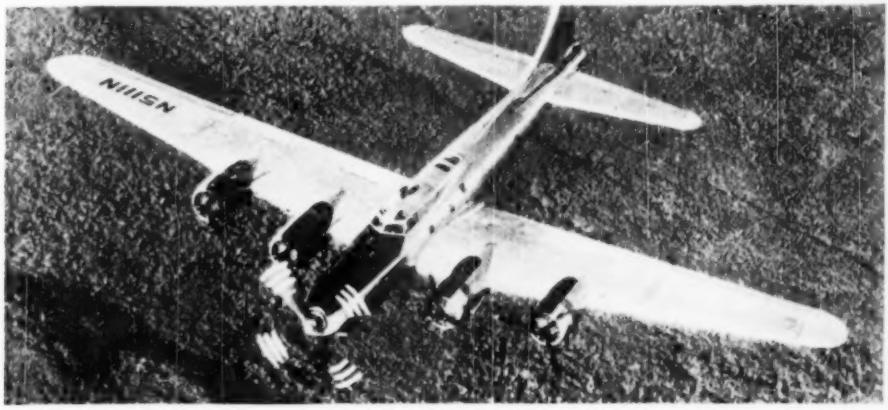


Ingenious Nordberg drive is explained in this simplified diagram. Gear train transmits no power. Its sole purpose is to prevent rotation of twin-flanged drive plate. Pinions travel in orbit around drive shaft's center line. Upper pinion meshes with stationary gear; lower one, with geared drive plate.

Man drawn to same scale shows comparative size of one of giant pistons and its con rod.

Navy Gets Most Powerful Turbo-Propeller Engine

The four regular propellers of the B-17 Flying Fortress making a test flight below have been stopped. A single four-bladed propeller in the nose is flying the big craft all alone, powered by a new 5,700-hp. Pratt & Whitney engine developed for the Navy. Called the world's most powerful turbo-propeller engine, it devotes 90 percent of its power to operating a gas turbine that turns the airscrew. The other 10 percent gives jet thrust. Weight of the new engine is only 2,550 pounds.



73 Kites Fly on One String

Another kite is launched to join the long string stretching out of sight to the upper left. While these pictures were being made, The Kite Man—Charles H. Baum—sent 73 into the air.

A New Jersey grandfather adds a new wrinkle to an old sport—keeping record flock in the air on a 2½-mile cord.

PS PHOTOS BY HUBERT LUCKETT

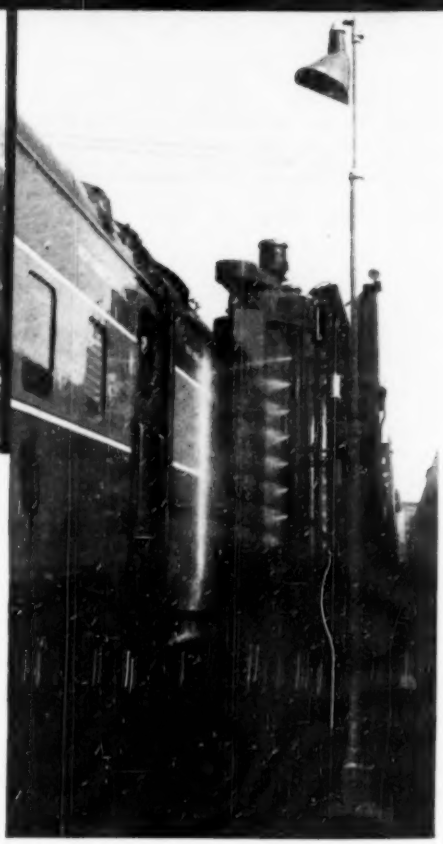
WHEN residents of the seashore communities along the New Jersey coast see the sky dotted with bright diamonds of red, green, blue, and white, they know The Kite Man is back.

The Kite Man is 70-year-old Charles H. Baum, whose unusual hobby is flying kites—not just one at a time, but as many as he can get into the air on the same string. This fall he set a record 73 of the tissue-paper craft soaring along 2½ miles of cord.

Mr. Baum, an accountant who once was secretary to former Secretary of War Henry L. Stimson, uses only a few simple pieces of equipment. The kites are the ordinary dime-store variety. (He buys them by the gross.) Three homemade reels and stands hold different weights of cord. When weather and business engagements permit, Mr. Baum stacks these things in the trunk of his car and heads for the beach and its steady breeze. He's been doing this for more years than he cares to admit. During World War II the Navy asked him to stop when it tired of explaining to spy-jittery residents that he was *not* signalling enemy submarines.

The Kite Man uses no special tricks to fly 73 at once. He doesn't even run to get them up. A properly adjusted kite takes off right out of his hand. The cross stick is fastened at right angles to the main stick and bowed about 4½ inches; the bridle balances the kite correctly (he ties it on about 4½ inches from the tip); the tail is the right length, from 7½ feet for a light breeze to 10 times that for a heavy wind. END

"I always have plenty of helpers," says Mr. Baum, who puts the inevitable crowd of kids to work tending cord and counting kites. Here he ties nylon thread that fastens kite to main cord.



Trains Get Daily Bath At Speedy Car Laundry

CRACK trains of the New York Central get a daily bath on a special washing track in New York City, where one of the most modern of railway-car laundries has just been installed. Two automatic car-washing machines, 680 feet apart, work on front and rear halves of a train simultaneously. As a train moves slowly past, rotary brushes scrub a car's roof (above) and sides (right) with cleaning solutions sprayed from jets. A 16-car train can be cleaned in eight minutes.

Mercury May Yield Most Precise Yardstick

THE luminous bull's-eye at left, produced when Westinghouse scientists bombard mercury with radar waves, may yield the world's most accurate "yardstick."

Since 1889, familiar kinds of measuring sticks have been based on the standard meter, a metal bar in a vault at Paris, France. Scientists needing a more precise standard of length have used the wavelength of red light from glowing cadmium, which can be measured with an accuracy of one part in 10,000,000. In 1947, the National Bureau of Standards proposed using the wavelength of green light from mercury 198, a rare isotope produced in the atomic pile, which could be measured still more precisely. The Westinghouse researchers are now making this measurement by gauging the diameter of the bull's-eye's circles and making complex calculations. The new mercury standard of length, they expect, will be accurate to one part in 40,000,000 or better.

Caged Jacks Tighten Bridge

THAT aluminum car you see sliding along the far cable is the latest thing for bridge jacks. High above the Hudson, they have the job of tightening some 3,360 bolts that hold the huge steel cable bands of the George Washington Bridge. With the car they can work under cover, dispensing with conventional scaffolding.

Army Tests New Troop Helmet

A NEW aluminum helmet with more head coverage and greater resistance to impact is being tested by the Army Quartermaster Corp. The plastic liner alone, shown above, is more resistant to shell fragments than the present liner and steel helmet together. The outer shell gives added protection and is still usable for washing or cooking.

Robot Takes Phone Messages

IF YOUR phone rings when you aren't home, the $300 device below will answer in your own voice and take messages on a wire recorder. On your return you listen to calls received during your absence. The gadget can also record two-way conversations. Telemagnet, not sanctioned by all telephone companies, is sold by Carl Fischer, N. Y. C.

Coal Cars Rebuilt as Tipple

FOUR railroad coal cars with their trucks removed were used by the builders of the unusual coal tipple shown below in the yards of the East Fairfield (Ohio) Coal Company. Mined coal is brought up the ramp and dumped into the shaker. Graded coal is then chuted into the proper coal car. Haulers load trucks under car hoppers.

5-Way TV Mast

A single unit atop the Empire State tower will handle simultaneous telecasts for most N. Y. stations—plus FM broadcasts.

By Martin Mann

PS PHOTOS BY HUBERT LUCKETT

THE world's tallest building is growing taller—for the benefit of New York television fans. Next month the Empire State Building will gain 156 feet—making it 1,467 feet high—when steelworkers rivet on a new TV antenna.

This new antenna is really eight antennas. It will serve five of the metropolitan area's

To find how new antenna would spread TV waves, unusual test measured signal it received from another transmitter while it rotated on stand (above). Drawing (left) shows how new addition to Empire State will look.

Stretches Tallest Building

seven TV stations and three FM stations. (Of the two telecasters omitted, one has just completed its own antenna tower atop a Hudson River cliff, and the other is about 10 miles outside the city, in Newark, N. J.)

Each video station will have its own section, the sections being simply placed one on top of the other. Four are identical in design—a type called "supergain"—differing only in size to suit the different frequencies. The fifth, and topmost, is called a "turnstile."

The new antennas are expected to help eliminate many of the technical troubles plaguing the big city's TV. All five telecasters will get an even break in the vital matter of antenna height (the top of the Empire State Building is the highest point on the Atlantic seaboard). Since television waves travel in straight lines, like light waves, and are stopped by the horizon or hills, this means that all five stations will be able to cover approximately the same area. Set owners in the region should then be able to get one about as well as another.

Manhattan Cliff Dwellers Benefit

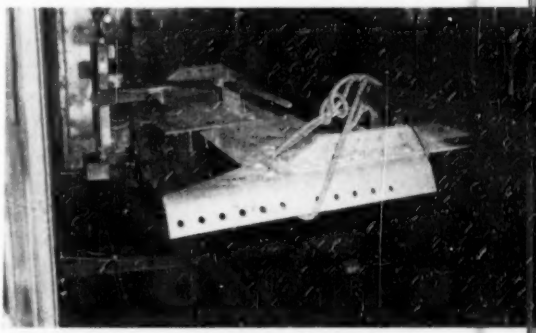
The centralized antenna should also exorcise many of the ghosts and shadows afflicting the screens of city dwellers. Ghosts—double images caused when the receiving antenna gets two waves, one direct from the transmitter and the other reflected off a building—should be reduced because the increased height of most of the transmitters will lessen the chance for reflections. Similarly, the higher antennas will cut the shadowing effect of big buildings, which block the direct TV wave almost completely.

TV servicemen are going to cheer the new antennas, too. No longer will they have to try to adjust highly directional receiving antennas to get decent signals from all the scattered transmitters. They'll just line up an antenna with the single point where the five transmitters are located.

The delicate job of rebuilding the tip of the tallest structure in the world has gone almost unnoticed—although office workers on the 79th floor must have been surprised to see an elevator shaft cough half-ton girders into their marble corridor.

That's the way all the material for the an-

1 Regular passenger elevators (above) carried structural steel for framework from basement to 102d floor. Antennas go up same way.



2 Girders were tied underneath the elevator cars and lashed to cables so they wouldn't swing, as shown in view up shaft, above.

3 Longest shaft in building goes only to 80th floor, so girder (under car) had to be transferred to another elevator at 79th floor.

tenna tower is being brought up—on regular passenger elevators. While this method is hardly child's play, it is considered safer than hoisting the pieces a quarter of a mile up over one of the country's busiest streets. A girder dropped that far would have about the same effect as a high-explosive bomb.

No elevator in the Empire State Building goes all the way to the top (the cable would be too heavy). So transporting the structural steel is a complicated job.

It starts in the basement, where the pieces are stored. A crew of steelworkers, using small chain hoists, dollies, and lots of muscle, lashes a girder underneath one of the building's two elevators that can make the longest trip, to the 80th floor.

At the 79th floor (the car is a floor above), the crew takes off the girder with great care—the shaft goes 1,000 feet straight down to the sub-basement. The piece is trundled across the hall to another elevator that takes it to the 85th floor, where it is again transferred for a ride to the 102d-floor observatory. Most girders make this last trip *inside* the elevator, which has been cut open at the top to accommodate their length. When the elevators aren't carting steel they go back to passenger service.

All Out at 102nd Floor

The 102d floor is the last elevator stop. A hoist on the floor above then takes over, lifting the girders up a stairwell.

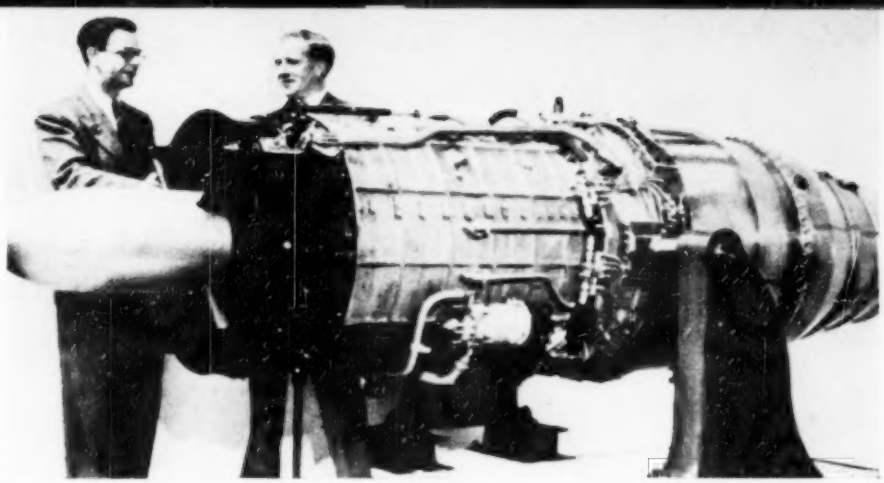
The supporting framework is being built in the ordinary way, from the bottom up. But the antennas will be erected from the top down—the strong, gusty winds above the framework are too dangerous even for daredevil steelworkers. The top antenna section will be jacked up so that the next lower section can be slipped into place and fastened to it. Then both sections will be jacked up while the third is put in position and fastened. This process will be repeated until the whole thing is erected.

When the new antennas go on the air—sometime early next year—they will inaugurate another chapter in the intertwined history of the building and television. The Empire State's height and central location made it an obvious choice for a TV antenna, and the first one was set up there nearly 20 years ago, soon after the building opened. Actually, the tower was intended for a mooring mast for dirigibles, but none ever used it, and now the new science of television has taken complete possession. END

4 Again on 85th floor girders had to be shifted to another elevator. Usually, the steel rode inside this car, which had hole in roof.

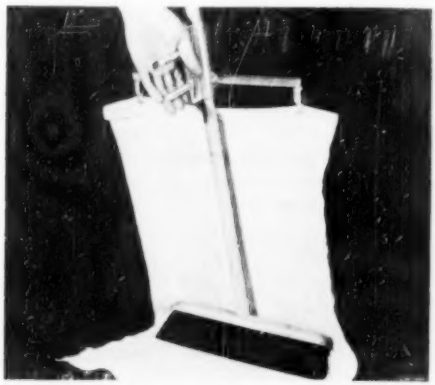
5 Last stop is 102d floor, where hoist (one story higher) pulled it from shaft and up stairwell. This floor is normally tourist observatory.

6 Same hoist put girder in place. This steel was now about 104th-story level—about quarter mile higher than when shown in first picture.



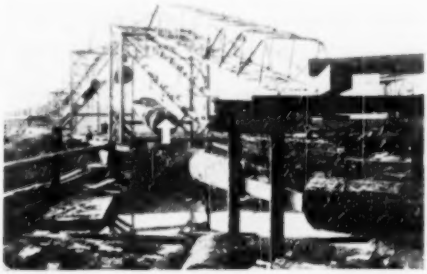
Most Powerful Jet Engine

CALLED the world's mightiest jet engine, the British-made Sapphire above is one of a pair in the Gloster Meteor 8 interceptor fighter. Their combined power exceeds the total of a Superfortress's four 3,500-hp. engines, and reportedly enables the Meteor 8 to outclimb any plane of its type in the world. Each fuel-thrifty Sapphire develops 7,200 pounds of thrust, 1,000 pounds more than any other engine in service.



Broom Becomes Dust Chaser

DAMP sweeping to banish dust is made easy by the Cloclamp, which fits any push broom and holds a moistened cloth trailing beneath the bristles. Squeezing and releasing a spring lock, as above, permits moving the clamp as often as necessary to bring a clean section of cloth into use. The Walter G. Legge Co., of New York, is the maker.

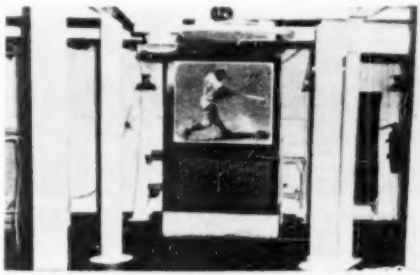


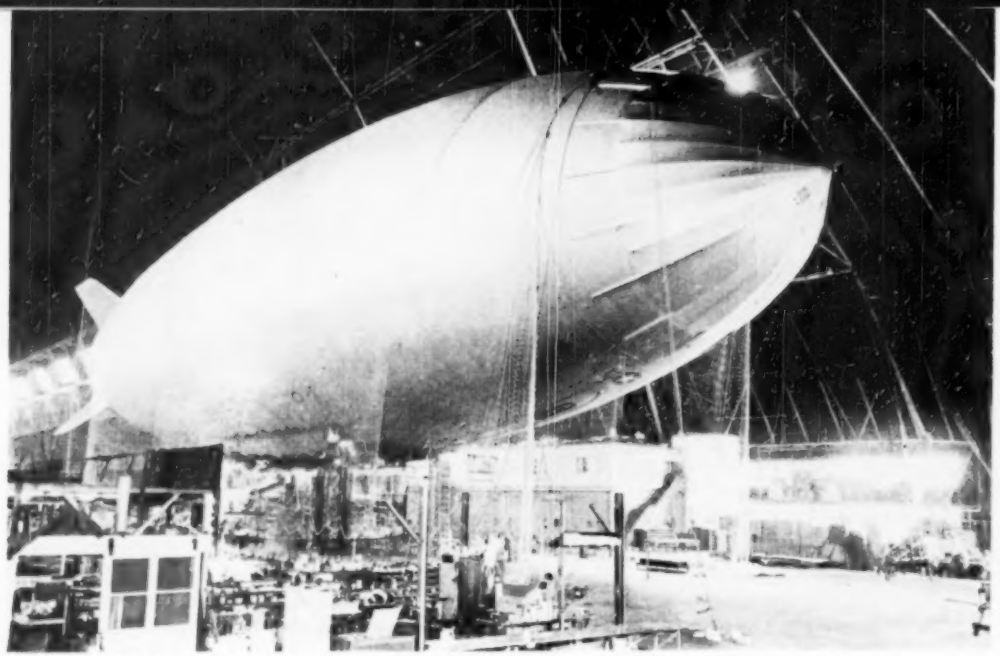
Logs on Tongs Ride Skyway

FORMERLY dragged by main force from pond to mill, five-foot logs now are picked up by hooks resembling giant ice tongs, and effortlessly whisked along this 892-foot aerial tramway to a veneer-making plant at Lewiston, Idaho. Two hooks suspend each log from a steel bar on trolleys (arrow) towed by an endless power-driven chain.

"Big Mo" Gets Television

TV HAS joined the Navy, with installation of the first receiver aboard the battleship *Missouri*. The giant projector set, right, has a screen measuring three by four feet. The maker reports Navy negotiations under way for mass purchase of TV outfits.





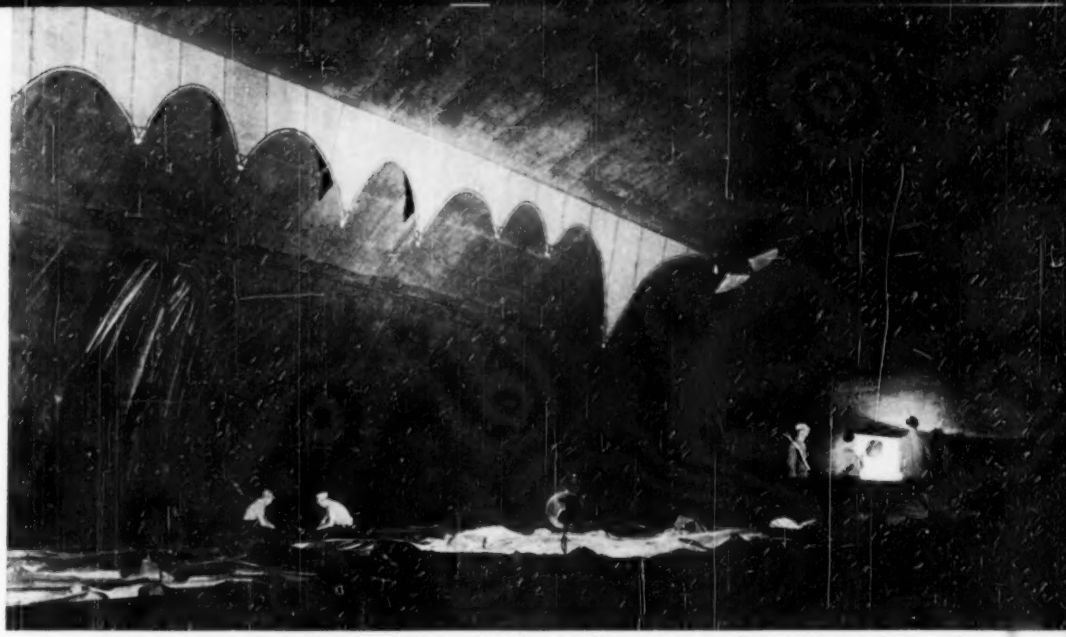
Newest and biggest Navy blimp carries a shroud of netting to hold it down against pull of helium while control car, engines, and elaborate anti-submarine equipment are installed.

Biggest Blimp to Fight Subs

LOOK at the picture at the top of this page. If war should come, you probably will be hearing a lot about this type of flying machine. It's the biggest blimp—nonrigid airship—ever built. And it was designed specifically to tote spotting devices, such as

Workmen prepare fittings inside huge Goodyear airship dock for new N-type airship. Special devices will let blimp refuel in flight from surface craft and re-ballast with salt water.

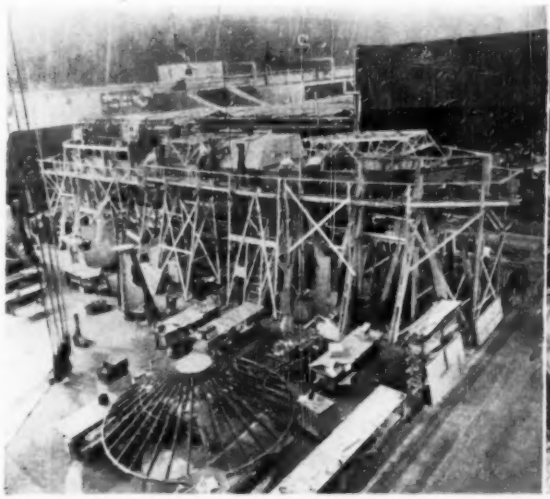
Sea of fabric comprising airship's envelope dwarfs rigger in center. Blimp's ability to fly low and hover over ocean for hours makes it a valuable adjunct to hunter-killer teams.



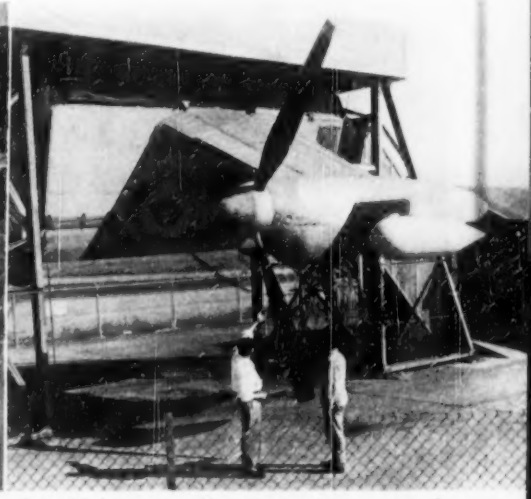
This is what a blimp envelope, here supported by a light framework, looks like from the inside. Craft is 324 feet long and 94½ high. This compares with K-type's 253 feet and 79 ft.

radar, sonar, and magnetic detection equipment, against enemy submarines.

As described in POPULAR SCIENCE last March (pp. 100-106), blimps really have come into their own against sub-sea craft, especially when teamed with airplanes and surface ships in hunter-killer groups. This new blimp, built for the U. S. Navy by the Goodyear Aircraft Corp., of Akron, O., is buoyed up by 875,000 cubic feet of helium gas, as compared with 456,000 used in World War II's K-type blimps. END



Framework houses 83-ft. control car under construction. Car will have two decks, one for operation, the other for crew's quarters. Structure in foreground is envelope's nose cone.



Two 18-foot propellers on outriggers, turned by two 7-cyl. radial engines in car, will drive blimp at 75-knots. Gearing permits either engine to whirl both props if one power plant fails.

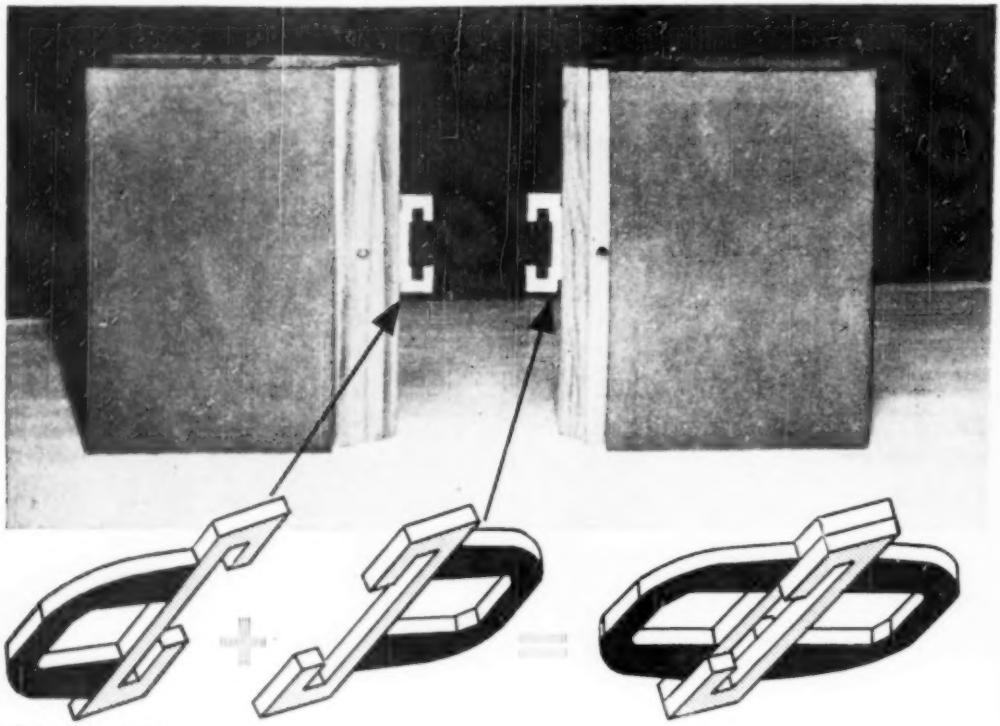
Look, No Nails: House Hooks Together

By Andrew R. Boone

A HOUSE that you can literally hook together is the latest wrinkle in prefabricated dwellings. The entire structure consists of pre-cut, modular panels that are joined together by a tricky locking device to form walls, ceilings, and roof. By simply varying the number and arrangement of the panels, any desired size and shape of house can be made—just like a child putting together a house with building blocks.

For most of the assembly, the only tool required is a hammer to tap the panels together and to nail in the beams and flooring, which are also pre-cut to the correct size. All of the parts for an average-size, two- or three-bedroom house can be packed on a truck (shown above, left), driven to the building site, and put together by several

1 How locking device joins panels together is shown below and at right. Matching connectors, shaped like squared Cs, are embedded in panel edges at 40-inch intervals. These are bent at slight angle so they slide past each other when panels come together, overlapping and forming an enclosed slot. Horseshoe-shaped ears hold connectors embedded in panel edges.



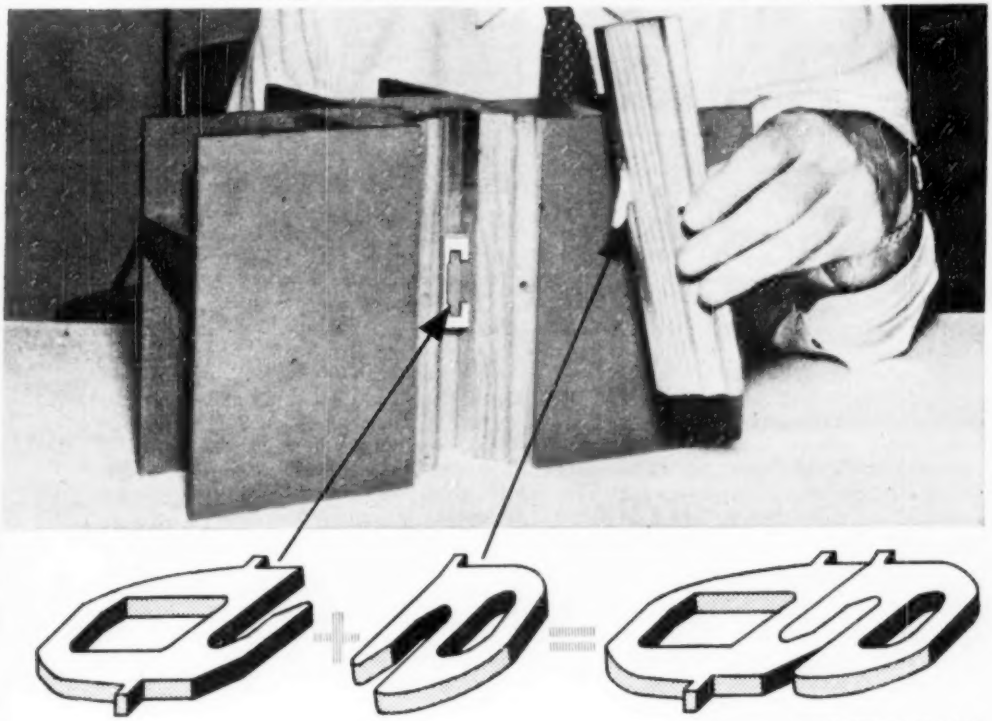
Two-bedroom models, like one above, take 76 to 78 panels. Only nailed parts are beams, floor.

unskilled workmen in as little as a week.

Each panel, which is a built-up sandwich of plywood sheets stretched over a frame with insulation in between, is exactly eight feet tall and 40 inches wide. Thus, by simply adding or subtracting panels, the length and width of a house can be made any multiple of 40 inches. Even the doors and windows, which come in a choice of styles, are made to the same dimensions so they can be placed anywhere in a house by merely substituting them for solid panels.

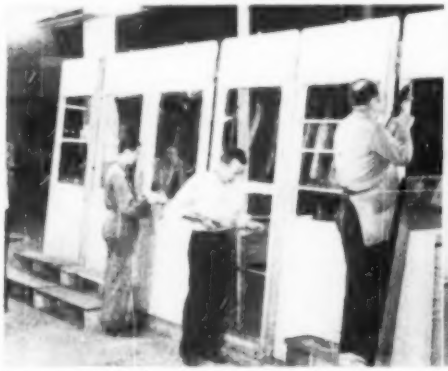
Since the panels are complete in themselves, containing their own insulation, no further facing on either the inside or outside is required. Already treated at the factory

2 When panels come together, hook-shaped connector is inserted at joint's side through slot formed by two C connectors. Then second hook is inserted at opposite side of joint. Hooks, one turned up and other down, interlock in center, holding C connectors together and wedging joint tight. Hooks can be embedded in either filler strips or edges of other panels for partitions.

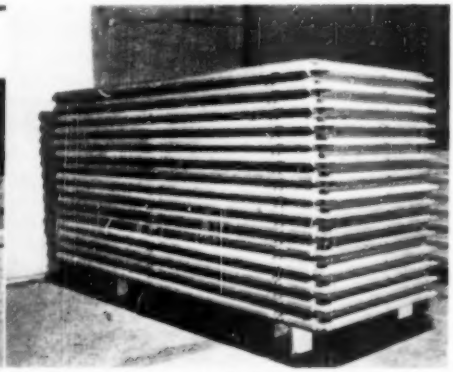


Panels are formed of wood frame covered on both sides with plywood sheets. Space between sheets is filled with glass-fiber or rock-wool insulation. Completed panel is 3¾ inches thick.

Sandwich of plywood sheets and insulation is permanently bonded together in this electronic gluing machine. Clamps grip panels every 20 inches to hold parts in correct alignment.



Door and window panels are made same size as solid ones so they will fit anywhere in house. Different styles of windows, including full-length, modern type, permit varied house designs.



Finished panels, stacked for shipment, show uniformity of mass production that cuts cost, simplifies assembly. Note rows of identical connectors along end and side edges of panels.

with a weatherproofing compound, they can be painted, stained, or just left natural for easy maintenance.

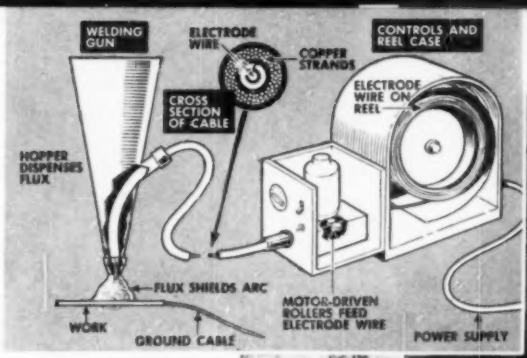
The panels hook together by an ingenious arrangement of metal connectors embedded in their edges. Spaced at exact intervals on all edges of the panels, the connectors can be used to make any type of joint required: wall-to-wall, wall-to-ceiling, or wall-to-floor. When two panels are brought together, as illustrated on the previous pages, matching C-shaped connectors overlap, forming a narrow enclosed slot. Then a filler strip, fitted with hook-shaped connectors, is inserted at each side of the joint. These hooks pass through the slot formed by the two C connectors, interlock in the middle, and wedge the joint tightly together.

Where interior partitions are to go, panels fitted with the same type of hooks are simply substituted for the filler strips. Thus partitions can be attached to exterior walls at 40-inch intervals anywhere in the house.

Produced by the General Panel Corporation, of Burbank, Calif., the new type of house is the brainchild of Walter Gropius, professor of architecture at Harvard University, and Konrad Wachsmann, German prefab expert. Realizing that the main disadvantage of many ordinary prefabs is their standardized appearance, the two designers set out to devise houses that would use uniform, mass-produced parts but have the individuality of custom-built homes.

The new houses, 544 of which are being built for Air Force personnel, range in price from $5,000 for a basic, one-bedroom unit to $50,000 for big, fancy jobs.

And there's one final advantage of the unique construction: If you ever want to move, just unhook your house and take it with you. END



Drawing at the top explains new welding process in use at right. Wire electrode is fed to gun through coil spring in cable; current, through surrounding copper strands. Insulated fitting in gun guides welding wire, and applies the current to it. Gun covers arc with granular flux.

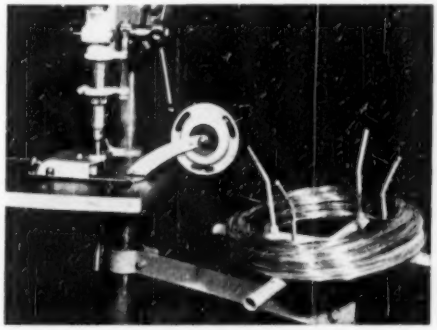
Electrode Fed Through Cable to Welding Gun

HIGH welding speed and a deeply penetrating arc are claimed for this new automatic-feed welding gun. One reason for its performance is that it uses a comparatively small electrode wire, centrally fed, at comparatively high currents. With a 5/64-in. electrode wire and welding heats up to 600 amp., current flow is said to be as great, in proportion to area, as if 10,000 amp. were used on a standard 5/16-in. electrode. The result, according to the Lincoln Electric Company, is faster welding, great penetration, less joint preparation, and less weld metal in the joint.

Superspeed Camera Shutter

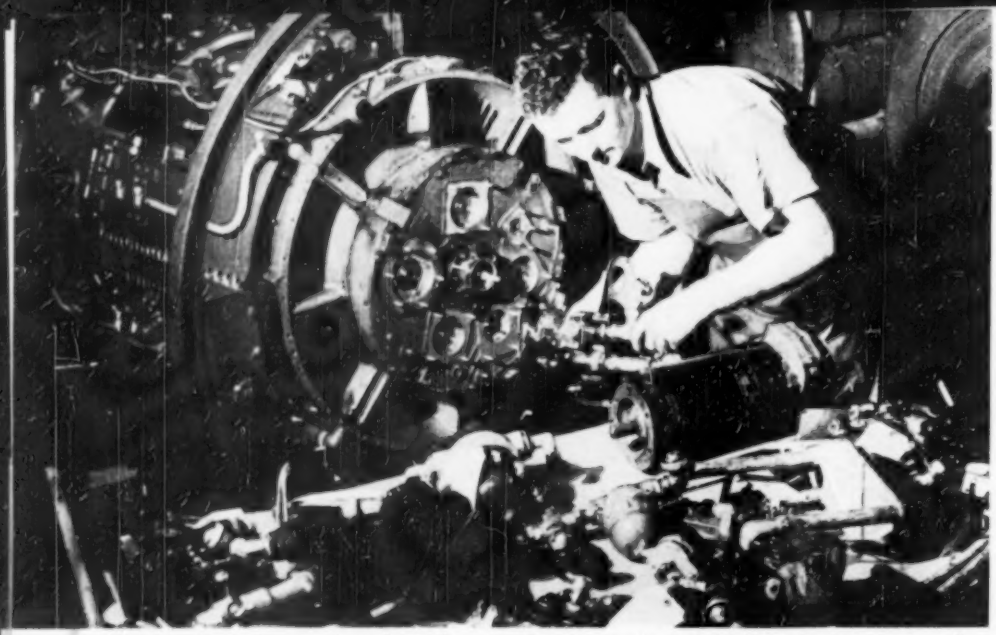
A SHUTTER of 1/100,000,000-second speed, perfected for military research, may soon be available for ordinary cameras at about $100. It has no moving parts.

Through liquid nitrobenzene in a glass tube, an electric impulse momentarily clears a path for a polarized-light beam, a phenomenon called the Kerr effect. The photo shows three shutters, one on a camera.

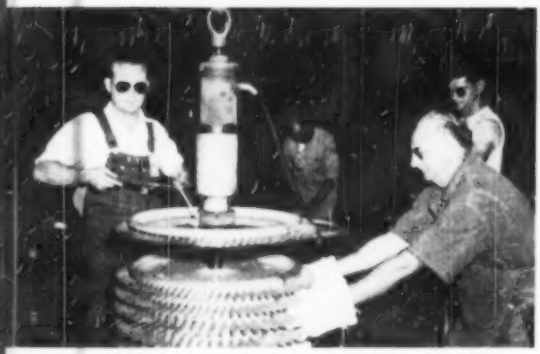


Springs Wound by Drill Press

ATTACHED in two minutes to a drill press, the Spring-Master converts it into a machine for making precision springs, of 3/16- to ⅝-in. outside diameter and any desired pitch and length. Fed from a spool or coil, the wire used may range from 6 to 28 gauge, or .016 to .071 in. Supplied by the Cycloid Corp., of Saugus, Mass., the accessory makes any plant its own spring factory.



That cartload of parts above has only some of the "accessories" that must be removed during the overhaul of this J-35 jet engine. Tags identify the parts for later reassembly to engine.



Rotor wheels are press fit over axle. To get them off for overhaul, hollow axle is packed with dry ice and wheels are heated with a torch. Contraction and expansion does the job.

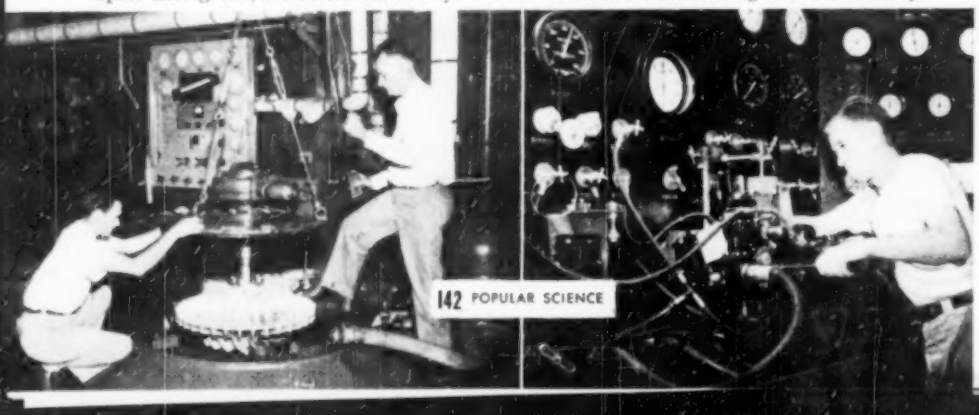
Giving Jet Engines New Lease on Life

SIMPLE jet engines don't look so simple when you take them apart for overhaul. Some have as many as 109 "accessories," plus delicate rotors and precision parts that are individually fitted together.

Rejuvenating these intricate machines is the specialty of Tinker Air Force Base, in Oklahoma City, to which U. S. jets from all over the world come for reworking. After intensive cleaning and testing there, they are ready to rejoin our fighting forces—actually better than new.

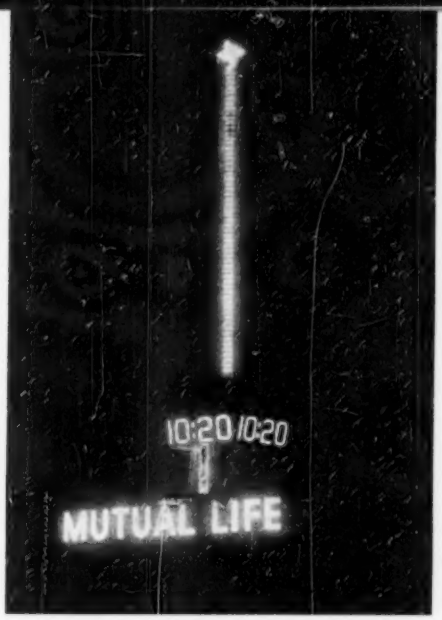
Reassembled rotor is tested by whirling it at high speed inside "spin pit" (under floor) lined with 21 layers of armor plate. If it doesn't fly apart during test, it's fit for more duty.

Complex equipment like panel below checks every part. Gas-turbine control being tried here has already had 14 man-hours of overhaul, will need five hours testing before final okay.



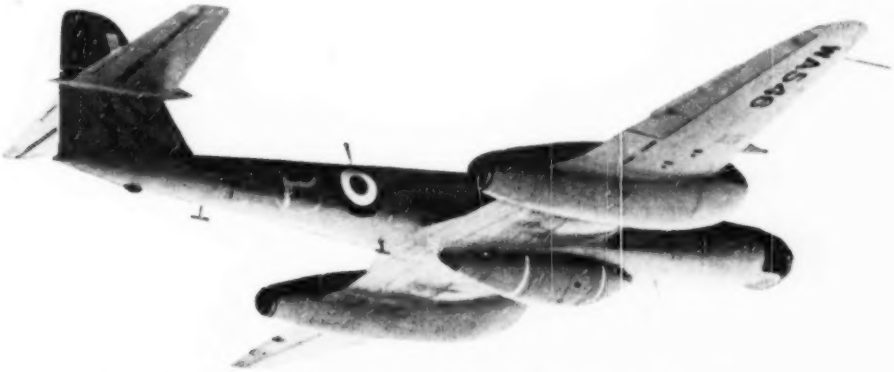
Suction Cups Lift Cargoes

POWERFUL suction cups in this new dock lift speed the handling of heavy cargoes. The loader has 18 of the giant cups, each with a lifting capacity of 900 pounds. When a cup comes in contact with a load, a trip mechanism opens a valve, starting suction that automatically grabs the load. A vacuum pump keeps the suction constant. Made by Vacuum Concrete, Philadelphia, the lift may cut some cargo-loading times in half.



Color Star Predicts Weather

RESIDENTS for miles around can tell at a glance what the weather will be from this illuminated color star atop the 25-story Mutual Life Building in New York City. The 10-foot star shines green for clear, orange for cloudy, flashing orange for rain, and flashing white for snow. Light bands move up the 150-foot mast for warmer, down for cooler. The display uses 4,200 light bulbs and 3,500 feet of neon tubing.



British Jet Airplane is Flying Radar Station

BRITAIN'S latest jet night fighter, the Armstrong Whitworth NF-11, features an elongated nose stuffed with radar equipment. Called the "Flying Radar Station," the plane is designed for night search and interception to guard against sneak bomber raids. The bulge beneath the fuselage is a belly fuel tank. Also visible, outboard of the engine, is one of the four 20-mm. cannon with which the plane is armed.

Inside Story of Basketballs . . .

Balanced Ball Built Around Wax Mold

By George H. Waltz, Jr.

PS PHOTOS BY HUBERT LUCKETT

JUST 59 years ago, James Naismith, a young physical-education instructor at Springfield College in Springfield, Mass., tacked peach baskets up on the walls at each end of the college gymnasium and, using a soccer ball, invented the game of basketball. His new game, Naismith felt at the time, was just something to keep the boys in good physical trim between the football and baseball seasons—it would never be popular.

Today, basketball is the *most popular of all* spectator sports. More fans now crowd into sports arenas and school gyms to watch the court game than flock to baseball parks or football fields. And the basketball has kept pace with the progress of the game. The present-day official basketball is a far cry from the unbalanced, stitched and laced ball that was used for years. It is a true, perfect sphere, as perfectly balanced as human ingenuity and skill can make it. It is laceless and stitchless, and according to the 1950 official rule book it must be of the molded type.

Birthplace of the Basketball

It seems only right that the most used method for making a molded basketball was invented in Chicopee, Mass., not more than five miles from where the first peach-basket game of basketball was played back in 1891. So, when PS photographer Luckett and I got our orders to get the inside story on basketballs, it was only natural for us to head for the Chicopee plant of A. G. Spalding & Bros. Inc., whose experts did the original development work. Thanks to their cooperation, POPULAR SCIENCE is able to show for the first time just how the famous "last-bilt" ball is manufactured.

Built like a Shoe

The name "last-bilt" is a thoroughly descriptive title, for the official ball, as made by Spalding and several other manufacturers under Spalding license, is literally built up over a mold, or last, in much the manner in which a shoe is made. In the case of a shoe, the last is wood. In the case of a basketball, the last is a hollow wax sphere. Unlike a shoe, however, the modern basketball is held together by vulcanization and not by stitches. And unlike either a football (PS, Oct. '50, p. 142) or the early basketball, it

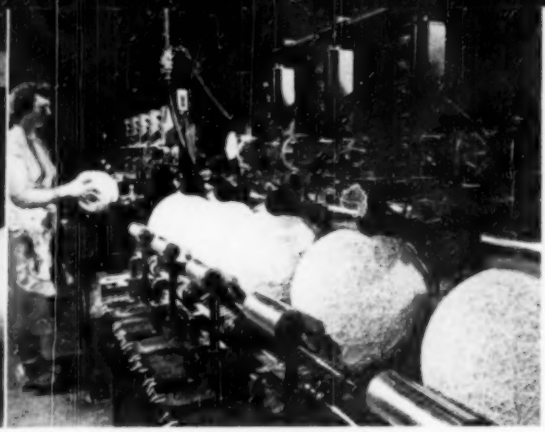
1 The last, or mold, over which a basketball is built is made of wax and is cast in a spherical metal mold. Molten wax is poured into metal mold and two halves are latched together.

This Spalding multiflash photo (10 exp. per sec.) shows Nat Holman doing a perfect lay-up.

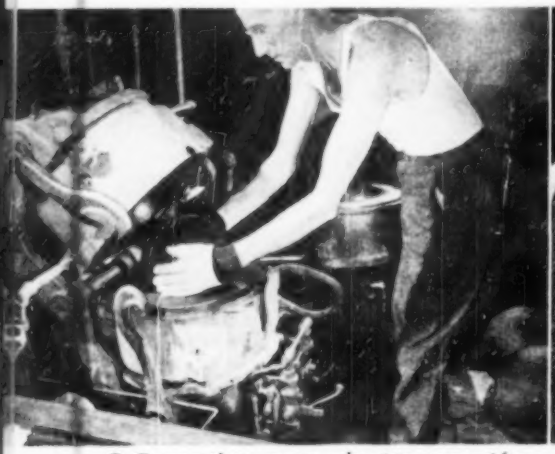
2 **Spherical mold** is then placed in a machine that spins it and rotates it through a water bath. Spinning distributes wax to form uniform hollow shell; water cools and hardens it.

3 **Coat of rubber cement** is then applied to the wax last. This is not part of the construction of the ball, but serves to provide a tacky surface for next step in the process.

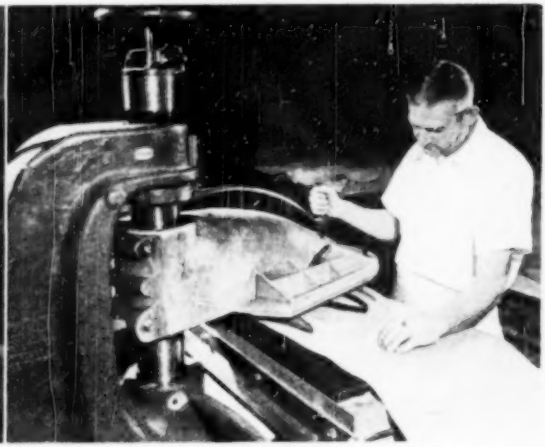
4 **Rubberized cotton strips** are next put into place on the tacky surface of the last. These strips form the innermost construction of the modern Spalding "last-bilt" basketball.



5 **Two windings of cotton cord**—230 yd. of heavy cord and 400 yd. of fine—are put in place over the fabric. This work is done on automatic machines that provide correct tension.



8 **Carcass** then goes to vulcanizing press. After press is closed, the rubber bladder inside is inflated. Heat plus internal air pressure combine to mold the carcass into ribbed sphere.



9 **Leather segments** for basketball covering are cut with a die on "clicking" machine. Operator places die on leather, pulls lever, and big mechanical hand taps die to make cut.

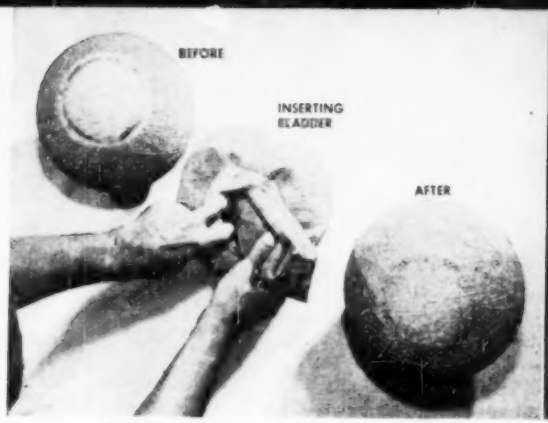
is put together right-side-out, not inside-out.

The wax last looks like a brownish-black bowling ball when it is lifted from the spherical metal mold in which it is centrifugally cast. Then, a few minutes later, after it has been given a coat of bluish rubber cement, the swirling brush marks give it the appearance of a small globe of the world. This coating of rubber cement is not a part of the final structure of the ball, but provides a tacky surface to make it easier to place the orange-peel panels of rubberized cotton cloth forming the ball's innermost layer.

On top of the cloth goes a winding of 230 yards of heavy cotton cord followed by a winding of 400 yards of finer cotton cord. These two windings, totaling more than a third of a mile in length, are put in place by automatic machines at just the right tension and give the ball its great internal strength. The wound ball, except for a small circular portion, is dipped in a rubber-cement bath to bond the windings.

Wax Removed Through Hole

The small uncemented portion of the wound ball serves a very important purpose. In this area, the cords are carefully moved to one side to form a small hole, and the hollow wax last, broken into small pieces, is removed. The rubber bladder with its



6 **Wax last** is then broken and removed through hole made by carefully parting cords in uncemented part of ball. After bladder is inserted, cords are put back in place and cemented.

7 **Rubberized cloth** coated with black rubber goes on over windings. Bladder inside ball is inflated for this operation. When rubberized fabric is in place, carcass is complete.

10 **Weight is important,** so leather segments, whose undersides have been coated with cement, and carcass are weighed to make sure finished ball will come within 20 to 22 oz. limits.

11 **Leather panels** are carefully worked into place in molded recesses of carcass by hand. This is skilled work. In photo, a flat tool is being used to smooth out any wrinkles.

two valves is then inserted and the cords are then put back into their original positions and cemented. No cord is cut or weakened, and when the skilled operators, who do this work by hand, are finished, it is difficult to detect where the cords have been disturbed.

The bladder is then inflated and strips of rubberized cloth coated with black rubber are placed over the windings. This forms the complete inner carcass of the basketball which next goes to a vulcanizing press. After being placed in the press, its bladder is inflated. The heat of the press plus the internal air pressure combine to mold the carcass into a ribbed sphere to take the final covering consisting of eight panels of high-grade cowhide.

The completed carcass together with the leather panels, which have been coated on their undersides with rubber cement, are then weighed on a sensitive scale to make sure that the completed ball will come within the 20- to 22-ounce weight limits specified by the rules.

After the leather panels have been worked carefully by hand into the recesses formed by the molded ribs, the ball is placed in a second vulcanizing press where heat and an inflation pressure vulcanize the leather in place. Finally, after cleaning and buffing, the completed ball is branded with its trade name

12 **More vulcanization** under heat and internal air pressure completes the fabrication of the molded ball. After press is closed, the ball is inflated to aid the vulcanization process.

13 **Branding** consists first of burning the trade name into the leather and then printing on the brand by placing a piece of inked paper between heated brand and the ball.

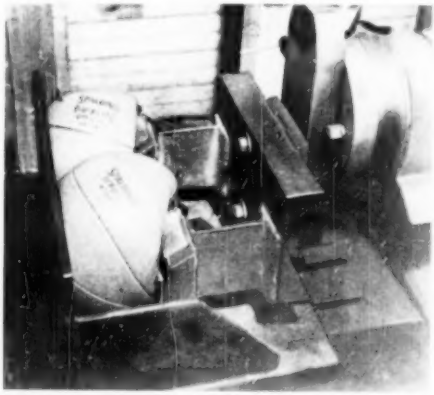
14 **Proper rebound** is important in a basketball. To be an "official" ball, it must bounce up to from 49 to 54 in. when dropped from a height of 6 ft. Shadow aids measurement.

and ink applied within the brand marks.

Besides weight, there are other strict specifications that must be met by an official ball. It must measure no less than 29½ inches and no more than 30 inches in circumference, and when dropped from a height of 6 feet it must rebound between 49 and 54 inches.

Oddly enough, the molded ball, because it is perfectly round and perfectly balanced, wears evenly all over and has been found to last at least three times longer than the old stitched and laced ball.

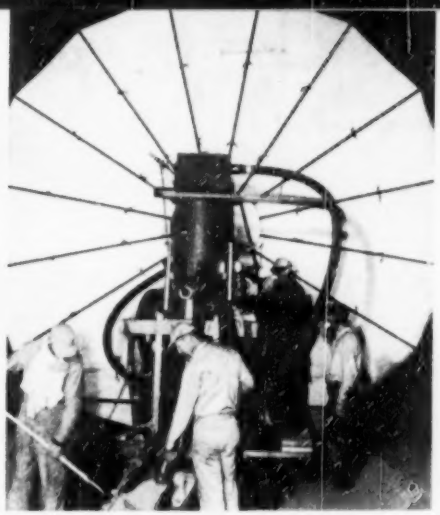
Spalding also makes white basketballs as well as white footballs. But not for the same reason. The white basketballs are not for night play, but are made especially for several mid-Western girls' schools where white basketballs are the fashion. END



15 **Punishment** is doled out to test balls by a machine-shop shaper which gives repeated 500-lb. pushes. Here a molded ball and a stitched ball are being tested. "Last-bilt" ball won.

New Ovens Cook While GIs Fly

No more cold K ration for GIs flying in the Air Force's big planes. New electrically heated ovens in the airplanes' galleys prepare piping-hot, full-course meals in a few minutes. Several different models have been designed, including the B-4 (above) for C-124 cargo ships and a tiny B-5 that practically serves dinner automatically to a fighter pilot while he attacks the enemy.



Sand-Blaster Cleans Pipe

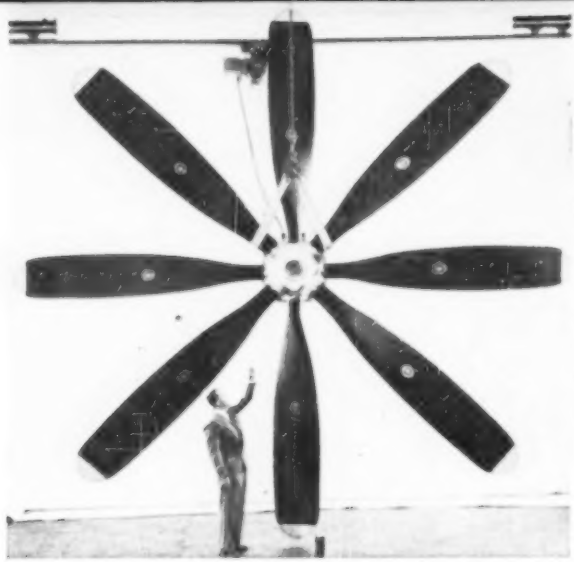
That's a pipe cleaner above—for a 22-foot-diameter steel-lined concrete pipe. Behind the spider-web shield are four revolving arms that blast abrasive material against the pipe lining, cleaning it to prepare for painting. The whole rig moves forward 25 feet an hour. It is shown in use inside the Soap Lake Siphon, which will transfer water for the Columbia Basin project.

Tiny Motor Tries Rocket Fuel

A "toy" rocket motor is trying out the fuels for tomorrow's space ships. Small enough to hold in your hand, it burns only two pounds of fuel a minute—a V-2 eats up 12 tons in that time. Yet this microrocket, developed at M.I.T., works just like the real thing, creating 300 pounds of pressure inside its ½-inch combustion chamber and a 5,000-m.p.h. exhaust stream at the nozzle.

Phone Holder Frees Hands

This device holds the telephone for you while you talk—leaving your hands free to make notes. The telephone handset fits into a rubber grip on a jointed arm that can easily be set at any position. To hang up, a metal weight is placed in the cradle, depressing the pins. The Phonearm, which sells for $6.95, is made by Central Technical, Inc., of New York City.



Prop Predicts Bigger Engines

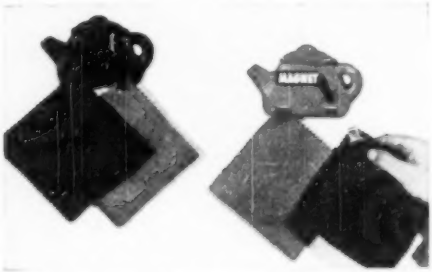
THE Octoprop at left is claimed by Curtiss-Wright to be the biggest and most powerful propeller in the world. Since the Air Force has ordered it, the presumption is that we will have an engine powerful enough to drive it—which means 10,000 to 15,000 hp. With blades of hollow steel, the prop is more than 19 feet in diameter. Although designed for a gas-turbine engine, the eight-bladed prop will be tested by the Air Force in a rig powered by electric motors. Alone, it can fly a 4-engine transport.

"Fish Pole" Flies Kite

You don't have to run to give this plastic airplane kite a start—just cast it out from a 30-inch wooden fish pole that is fitted with a reel of flying thread. When the wind catches the plane's wings, they begin to spin, making a clicking sound like a motor and lifting the toy into the air. The plane has a 9-inch body and an 18-inch wingspread. According to the Skycraft Mfg. Corp., of Long Beach, Calif., the kite has been flown as high as 2,500 feet; and several of the planes can be flown in tandem. It is priced at $1.30.

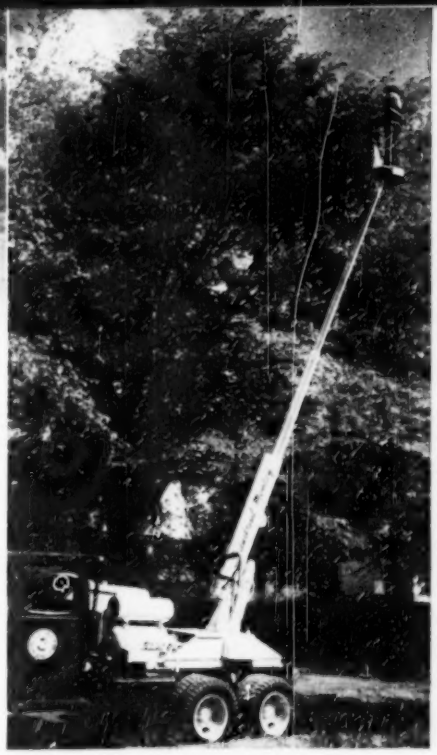
A Squeeze Seals Envelopes

A SPONGE roller at the end of this Bakelite plastic sealer moistens envelopes and labels without washing away glue, according to Northeastern Plastics, Inc., of Boston. A slight squeeze of its flexible tube starts water flowing into the roller by capillary action. Housed in a fender, the roller won't wet the surface on which it is laid.



Hot Pads Hang on Magnets

THE pot holders above are fastened to the teapot-shaped wall plaques by magnets, instead of hooks, making it easy to grab a pad in a hurry. Metal clips on the pot holders cling to the magnets. Available in yellow, blue, red, or green, each plaque has room for two pads. Ronald Eyrich, of Milwaukee, Wis., prices the item at $1.

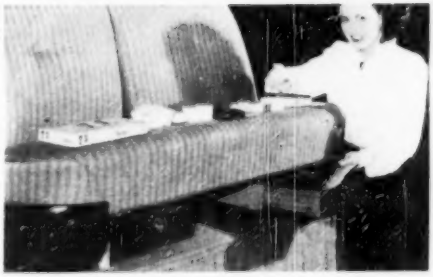


Boom Boosts Worker 40 Feet

THE climbing agility of monkeys is just a push-button job for the mechanized "Tarzan" at right who shot himself up to 40-foot-high treetops in 20 seconds. And, secure on his lofty, rail-guarded platform, he can swing himself in a 270° arc to cover a working area of almost 1,200 square feet.

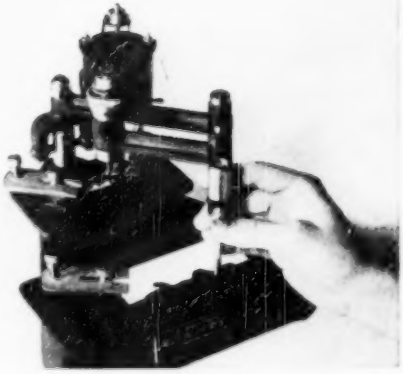
The steel boom, called the Industrial Monkey, can be mounted on almost any truck of 1½ ton or larger. Telescoped, the boom is only 16 feet long. Hydraulically operated, its movements are controlled by foot buttons on the platform, which is self-leveling. Capital Industries, Portland, Ore., says it is being used for fruit picking, street-light repairs, and power-line maintenance.

Drawers Fit Under Seat

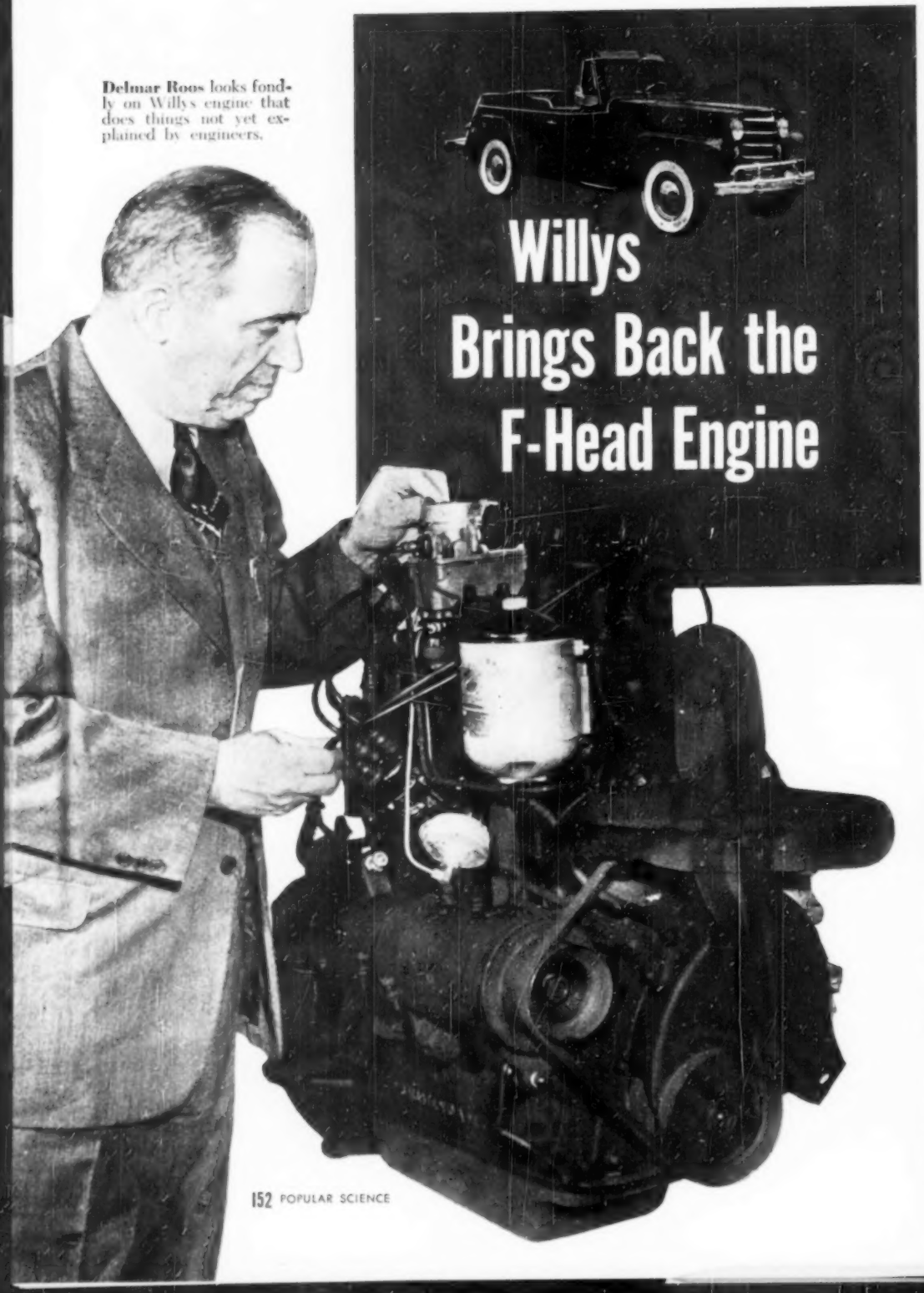


THERE never seems to be enough room in the glove compartment for all those odds and ends you want to take along on a trip. The answer may be the steel drawers at right that slide into the waste space under the front seat. No tools are needed to install them. Just slip them under the seat and snap into place. General Steel Products Corp., Flushing, N.Y., makes the 350-cu.-in., $6.95 AutoDrawr to fit most popular cars.

Tool Copies Master Patterns



A VERSATILE craftsman's tool is this duplicator that makes reproductions in wood, plastics, or steel. Actually a midget milling machine, Milli-Tool can be used for engraving, lettering, template making, glass cutting, and turning. The master pattern is fastened under a tracing point, which is moved by hand. A powered cutting stylus follows this movement, and reproduces accurate copies of one-third size. High cutting speeds of 20,000 r.p.m. are provided by a universal motor. Both flat and three-dimensional work can be handled. Sold for $79.50 by Mico Instrument Co., Cambridge, Mass.



Delmar Roos looks fondly on Willys engine that does things not yet explained by engineers.

Willys Brings Back the F-Head Engine

A veteran automotive engineer experiments with an engine, comes up with something better than he anticipated.

By Devon Francis

DELMAR G. (Barney) Roos, first vice-president of Willys-Overland Motors, Inc., is a man who has a lion by the tail, and he couldn't be more pleased about it. The lion is the first F-head engine in the U. S. passenger-car field in more than 20 years.

An F-head engine is a sort of semi-valve-in-head. Or, if you prefer, a semi-L-head. The intake valve opens right over the piston, while the exhaust valve stays in an ante-chamber.

Some weird and wonderful things happen inside the Willys F-head engine when you step on the gas. For instance, the engine runs without pinging at much higher compression than the Willys L-head, using run-of-the-mill gasoline. At full-throttle test-running, it loses little or no power after 100 hours, whereas most engines fall off 5 percent or more. It gets up to 25 percent better fuel economy than the L-head. It is much less sensitive to accumulations of carbon.

Ask Roos why, and he will reply that the company is still investigating.

"When we started on this engine, as a matter of fact," he remarked to a POPULAR SCIENCE reporter, "we had no idea of how good it was going to be."

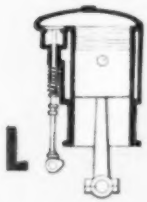
While Roos probably knows more about his engine than he cares to admit, his satisfaction at its showing, since its introduction a few months ago, is undoubtedly genuine. His associates say that he is prouder of the F-head than he is of anything he has done in his many years in the auto business—and that includes design work on such honored buggies as the Locomobile, Pierce-Arrow, and Marmon.

Some factors in the F-head's performance are no mystery. One of them is the size of the intake valve and its position. It's the biggest, in proportion to cylinder bore, in U. S. passenger cars—2 in. across. It isn't "masked" by the sides of the combustion chamber. In practically all L-head engines, about a third of the valve perimeter is partly masked to full, free breathing because the sides of the chamber prevent the gases from completely surrounding the valve. In the Willy's F-head the king-size intake valve is free to accept inrushing gas around its entire perimeter. Some masking does occur on the exhaust valve but isn't as important.

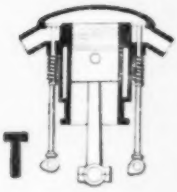
Another reason the new F-head acts as it does is the shortened distance between carburetor and intake manifold. The manifold is cast into the head and the carburetor sits right on top. The gas turns the fewest possible corners.

Still another reason is jacketing the whole manifold with thermostatically controlled water. Most automobile engines encourage the continued vaporizing of gasoline in the manifold by the application of exhaust heat, though temperature is hard to control. Willys' temperature control is precise over the entire manifold.

Finally, the F-head spark plug is practically at the volumetric center and at the highest point of the combustion chamber. That

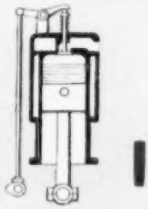


L-head has been commonest arrangement until recently. Intake, exhaust valves are alongside each other in chamber that extends beyond side of cylinder wall. Second valve is directly behind one shown in diagram.

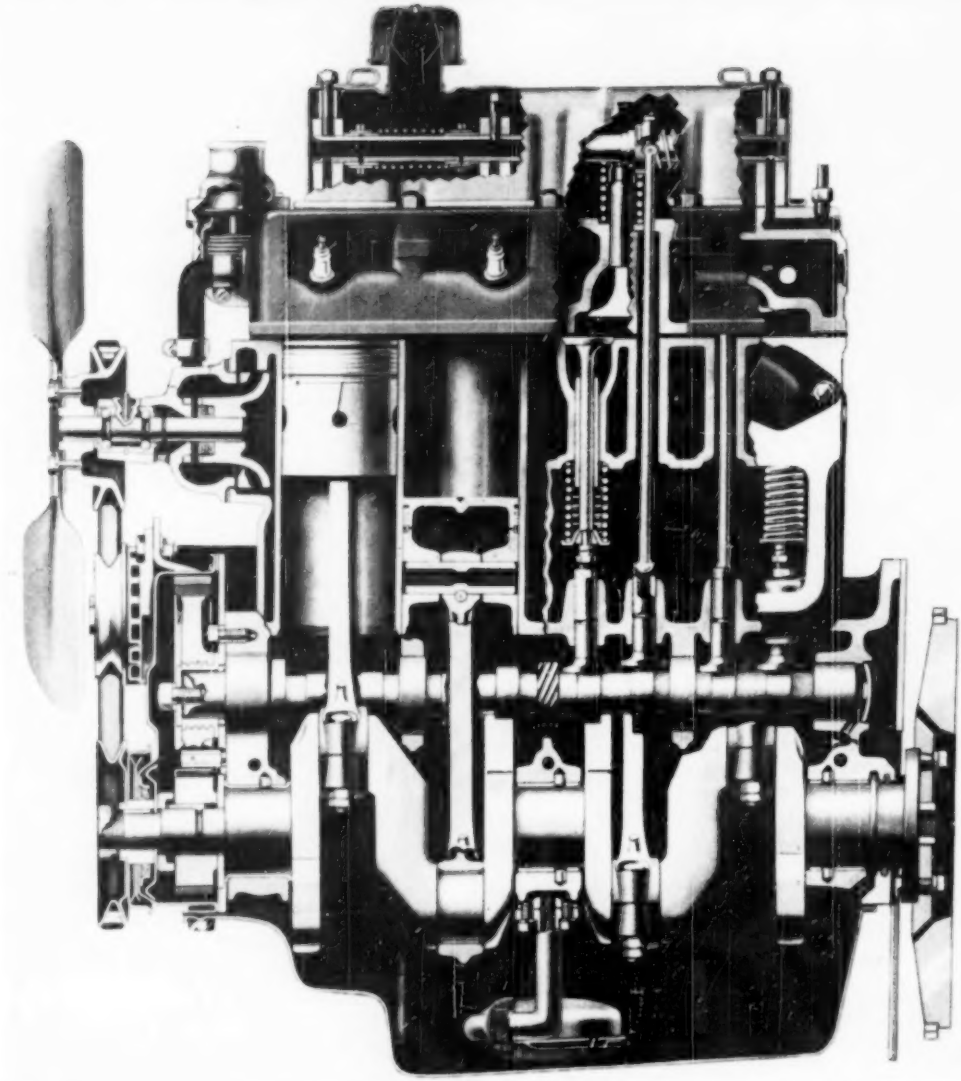


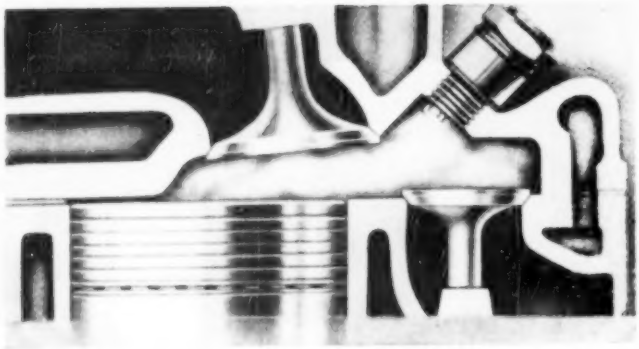
T-head, little used today, has chambers for intake and exhaust valves at opposite sides of the cylinder barrel. It requires two camshafts.

Valve-in-head or I-head engines, coming into favor with higher compression, puts both valves in tandem at top of combustion chamber, above piston. Second valve is hidden in diagram by the one shown.



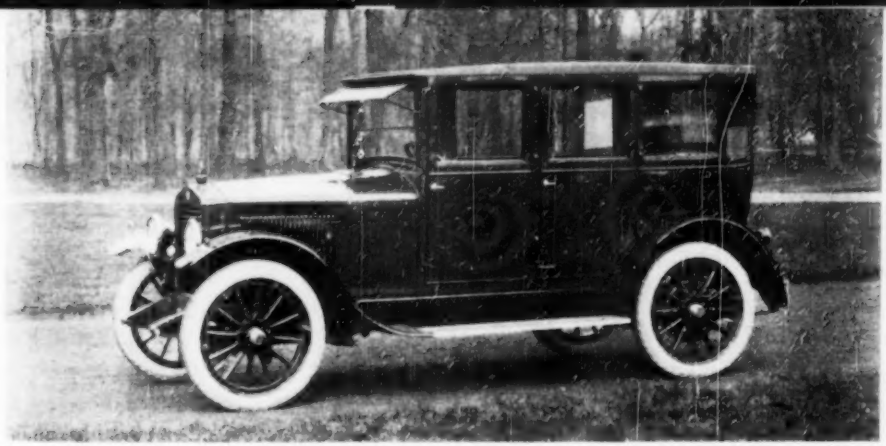
F-head compromises between L-head and I-head. Intake valve is in head, exhaust valve at side. Despite complication, one camshaft suffices.





Cutaway of Willys engine shows valve, camshaft arrangement. Horsepower per cubic inch of piston displacement is .536, the highest in automotive industry except for Crosley's.

Valve positioning is compact. Exhaust valve is 1.46 in. in diameter. Intake valve unseats .26 in. but exhaust valve, due to smaller diameter, unseats .35 in. in operation.



This Essex of 31 years ago had an F-head engine, as did Locomobile that won Vanderbilt Cup race in 1908. Essex used this form of head until 1923 when it changed to the L-head type.

helps the gas charge burn without knocks.

The Willys 4-cylinder Hurricane engine, as they call it, is the result half of design and half of experimental accident. Roos wanted to get a higher compression for greater power and economy without the expense of a complete retooling job. Moreover, to scrap his old L-head entirely would have meant complicating the repair of 1,200,000 Willys cars in the hands of owners.

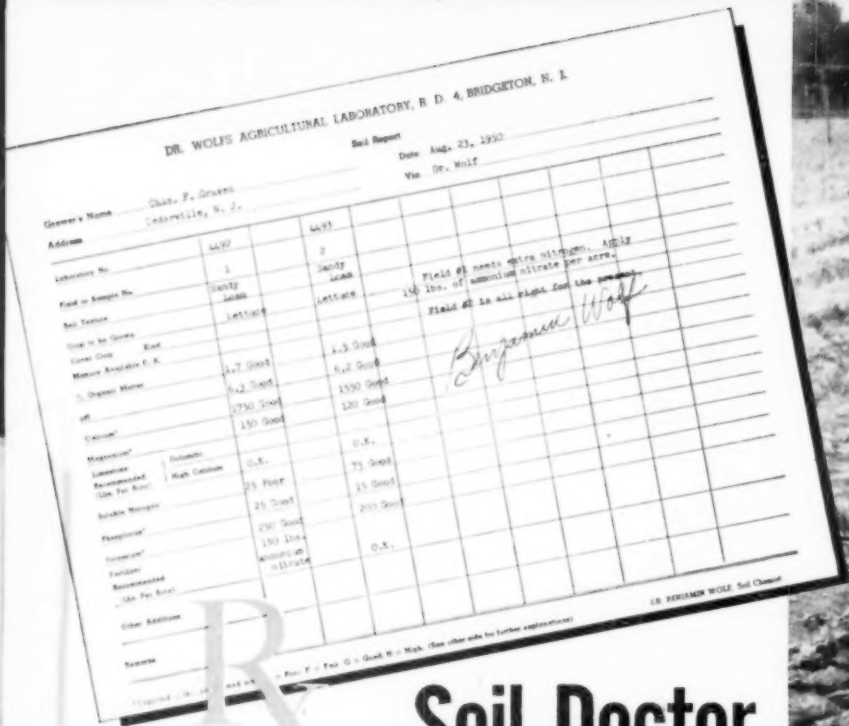
So he compromised. He redesigned the head. Except for that, the new valve and its train, and a new camshaft, the Hurricane differs not one whit from the former L-head. But here's what he achieved:

About 15 percent more torque; a jump of 11 hp. to 73½; a jump in compression ratio from 6.5 to 7.4-to-1; and a drop in fuel consumption per horsepower-hour from .565 pounds to .495 at full throttle.

It has been a long time since the U. S. had an F-head engine in a passenger car. The Hudson Super-Six sported an F-head in 1928 and 1929. Perhaps the best-known F-head was the 1919-1923 Essex.

Willys' revival of the F-head isn't stopping with the 4-cylinder engine. They have a 6-cylinder F-head under development. So (the Willys people tell you with knowing grins) have competitive companies. END

Several European-made cars, like this British Bentley, have used F-heads for years. In fact, it was the success of F-heads abroad that inspired Willys to experiment with the design.


DR. WOLFS AGRICULTURAL LABORATORY, R. D. 4, BRIDGETON, N. J.

Soil Report

Date Aug. 23, 1950

Via Dr. Wolf

Grower's Name Chas. F. Graves

Address Cedarville, N. J.

Laboratory No.	4497		4497							
Field or Sample No.	1		2							
Soil Texture	Sandy Loam		Sandy Loam							
Crop to be Grown	Lettuce		Lettuce							
Cover Crop Kind										
Manure Available T. A.										
% Organic Matter	4.7 Good		4.3 Good							
pH	4.2 Good		5.2 Good							
Calcium*	2750 Good		1550 Good							
	150 Good		120 Good							
Magnesium*										
Limestone Recommended (Lbs. Per Acre) Dolomitic	O.K.		O.K.							
High Calcium			75 Good							
Soluble Nitrogen	25 Poor		35 Good							
	25 Poor		200 Good							
Phosphorus*	250 Good									
Potassium*	150 Low		O.K.							
Fertilizer Recommended (Lbs. Per Acre)	Ammonium Nitrate									
Other Additions										
Remarks										

Field of needs extra nitrogen. Apply 150 lbs. of ammonium nitrate per acre.

Field is in six eight for the present.

Benjamin Wolf

Chemist

* Poor P = Poor G = Good H = High (See other side for further explanations)

DR. BENJAMIN WOLF, Soil Chemist

Soil Doctor Prescribes for Crops

By Ladd Haystead

PS PHOTOS BY W. W. MORRIS

FARMING has been likened to bucking a crooked poker game at a border resort. But constant research has done much to take the gamble out. A recent help, hitherto unavailable to the ordinary farmer, is soil analysis of a new and refined kind.

Among a few pioneers in this field is a young soil chemist, Dr. Benjamin Wolf. He has set up a laboratory, in Bridgeton, N. J., to service an intensively farmed area that supplies Eastern metropolitan markets with a good part of their vegetables.

A Rutgers graduate, Dr. Wolf was soil chemist for eight years with Seabrook Farms, believed to be the world's largest vegetable grower. Recently he decided to bring to small farmers the tests and service that have been at the command of the biggest and best-financed growers. Further, he had a new concept of soil testing that he considered a marked improvement over old methods.

Soil testing has been around since World War I. Big commercial farms have found it valuable, and lately there is an upsurge in demand for more testing from farmers all over the country. Experiment stations have made a valiant attempt to meet it. Most are prepared to do only a partial job, such as testing requirements for lime—or perhaps for lime, humus, and phosphorus.

Even so, demand has grown so great that some stations report they are six months behind—which means that the farmer loses a whole crop season. Lack of funds and personnel are experiment-station handicaps. But even a well financed and manned station would still leave a gap, Dr. Wolf thinks.

Soils usually are tested before the crop is planted, and the recommendation is for enough fertilizer to last out the growing

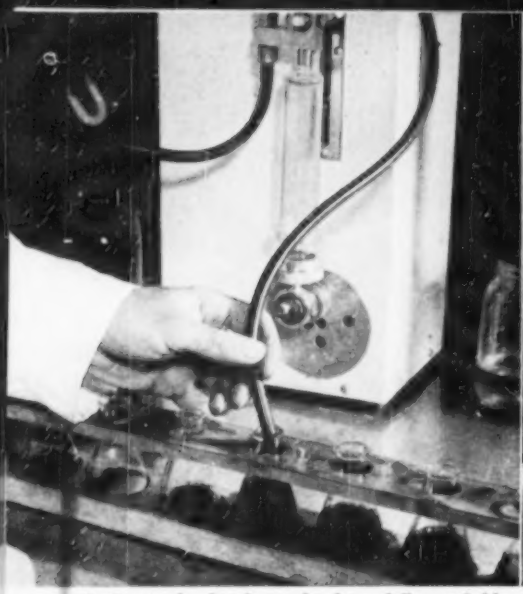
1 Taking soil sample, above, is first step toward fertilizer "prescription," left. In Cedarville, N. J., lettuce field, farmer Charles F. Graves watches Dr. Wolf use one of the two sampling tools shown. As crop grows, sampling continues, and fertilizer is spread between rows.

season. Obviously no one knows how wet or dry the season will be, and hence how much of the nutrient material will be lost to leaching, or unavailable to the crop for lack of moisture to put it in solution.

Continuous soil testing is needed to reduce hazards and cut costs, Dr. Wolf concludes. Instead of recommending a whole season's plant food on the basis of preplanting tests, he suggests using enough to get started—then holding back until growth is under way. His goal is to get and keep the soil in a high state of fertility, rather than hit it hard once and let it run down. Post-planting tests and observation enable him to maintain good nutrition right up to harvesting time, giving bigger yields of better quality. This continuous supervision is something the overworked experiment stations could not possibly provide.

Also, few of the stations are prepared to make tests and recommendations for trace minerals—minerals present only in minute quantities. Though needed only in small amounts, these elements have lately been found to play a vital role in plant feeding, and deficiency diseases result from lack of them. Tests for important trace elements including magnesium, iron, manganese, copper, and boron are included in Dr. Wolf's

2 Drying and sieving a soil sample, in Dr. Wolf's laboratory, prepares it for checking on nutrients, organic matter, and acid-alkali balance. Short-cut tests replace textbook methods of chemical analysis, for speed is of essence to get results in time to aid farmer.



3 Portions of soil samples from different fields go into separate flasks, and metering pump adds solution of acetic acid and sodium acetate to dissolve nutrient elements. Extract is decolorized with charcoal, filtered, and apportioned into vials to test for each element.

4 Blue color appears as phosphorus-testing reagent is added from quick-acting measuring bottle devised by Dr. Wolf. Depth of tint reveals whether soil needs more phosphorus or has enough. Test reagents for other nutrient elements give yellow, green, and red colors.

procedure, as well as tests for nitrogen, phosphorus, potash, calcium, organic matter, and pH, or acid-alkali balance.

Dr. Wolf set up his new service in May, 1949. At first, customers were few. But word soon spread that the service saved more money than it cost, by recommending lower fertilizer usage. And yields and crop health proved better under the Wolf plan.

This seeming paradox is explained by the fact that local customs in fertilizing practices depend, by and large, upon the crudest sort of rule-of-thumb. Farmers, home gardeners, pasture growers, and fruit growers in one community will all use a 5-10-5 fertilizer—five pounds of nitrogen, 10 pounds of phosphorus, and five pounds of potash per 100 pounds of dry material. Their only reason is that "everyone has always done it." But no two crops call for the same formula; nor do two soils use a given formula the same way. The required diet varies with the type of soil, amount of moisture, and nutrient requirements of the particular crop to be grown on that soil. There is an optimum amount of fertilizer; more is a waste; too much may even kill the plant.

Tailoring plant food to fit the crop, and saving money while doing it, brought in the customers. By the end of his first year, Dr. Wolf had 20,000 acres under consultation, and two assistants at work. This winter he plans to establish a branch laboratory in Florida, where he successfully introduced his ideas during a visit last fall.

Dr. Firman Bear, Rutgers soil chemist and editor of "Soil Science," estimates the worth of a soil-testing service like Dr. Wolf's as at least a dollar an acre. Since there are 400,000,000 acres of arable land in the country, the potential value on a national scale would be $400,000,000 or more.

Soil Analysis a Promising Profession

Thus, at a time when traditional professions are overcrowded, soil testing beckons to young men seeking a life vocation. Dr. William Martin, dean of the New Jersey College of Agriculture, states the case:

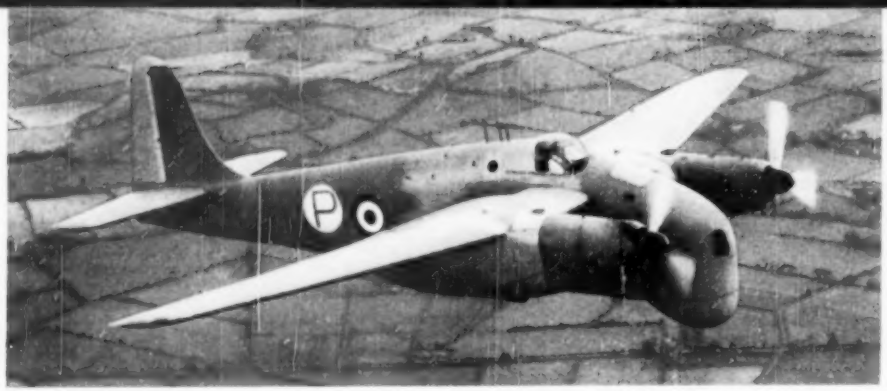
"Farmers find soil tests so valuable that more samples are being brought to our agricultural colleges, which developed the tests, than our soil chemists can handle.

"Recently a number of private soil-testing laboratories have been established. For a fee, the chemist in charge not only tests the soil before a crop is planted, but follows the crop through the season, making supplemental tests to the grower's further advantage. The opportunity for capable agricultural chemists to establish such services is excellent."

5 Cloudiness, instead of color, is formed by test reagents for some nutrients, and is accurately measured by electric eye in this instrument. Test being made, for potassium, will tell how much potash the soil needs. Same instrument is used in test for organic matter.

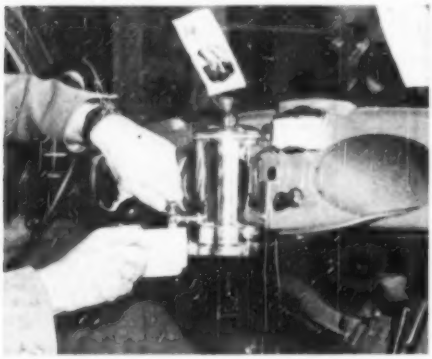
6 Another electric instrument measures soil's pH, or acid-alkali balance. This test, on a portion of soil sample placed with-distilled water in paper cup, shows if lime is needed. Comparing all test findings, "soil doctor" can prescribe right fertilizer to grow any crop.

Research of his own adds to store of knowledge applied by Dr. Wolf in testing 3,500 soil samples yearly, and prescribing crops' needs. Above, he tests effect of zinc-containing fertilizer, not yet on market, on bean plants in experimental frames behind his laboratory.



Subchaser Has Radar Nose

THE hook-nosed Short S.B. 3, pictured above on its initial test flight over North Ireland, is the fourth British anti-submarine plane to make its first flight within less than a year. A search and strike aircraft, it is powered by two Armstrong Siddeley Mamba turboprop engines. It carries a full load of the latest anti-submarine equipment, and the pachyderm-like proboscis houses special radar for pigboat hunting.



Coffeepot Hooks on Car Dash

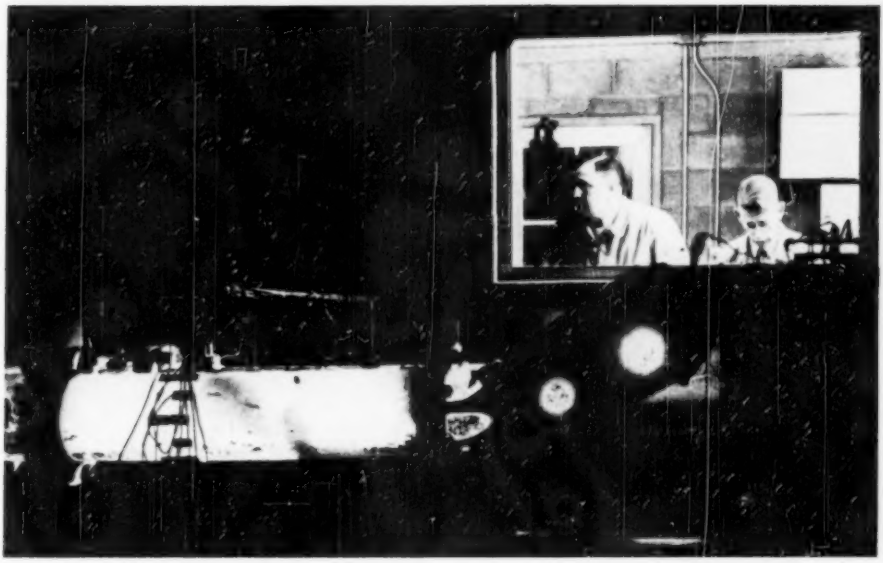
LATE risers who miss that morning cup of Java in the rush to the office can still get it by using this midget coffee maker that hooks onto the car dashboard. Made in Frankfort, Germany, it is operated by current from the generator, and holds 3 cups of coffee. The container can also be used to prepare soup or boil eggs for hungrier husbands.

Ukulele Playing Made Easy

EVEN a person without musical knowledge can strum a ukulele along with the best of them, claims the maker of this plastic device that fits the throat of any standard ukulele. By pressing any of six buttons, a player can strum a true chord. The device and a book of 40 song arrangements sells for $1.49 by Emenee Industries, Inc., N. Y. C.

Jet Engines Propel Boat

IN WHAT is claimed to be the first test of pure jet propulsion on water, the converted paddle boat *Lucy Ashton*, at left, roars along the Clyde, at Dumbarton, Scotland. She is powered by four Rolls-Royce Derwent V engines, similar to those used by jet fighter planes. Mounted in a bank on the deck amidships, each of the engines develops 3,500 pounds of thrust. Speeds attained during the trial runs were not disclosed.

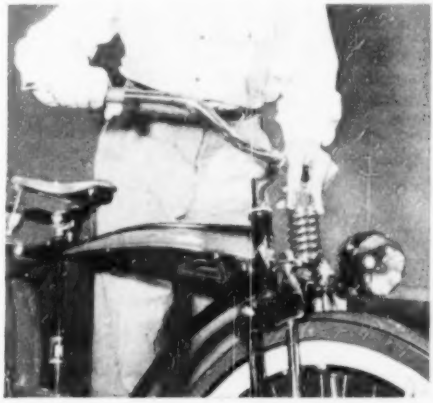


Exhaust Heats Pipe Red Hot

SEARING gases spewed out by a turbojet engine at 1,000 feet a second and a temperature of 1,600° F. heat an exhaust pipe (left) cherry red during a night run in the Texas Co.'s new jet laboratory. The two light spots at right are quartz observation ports for studying the flame pattern. Engineers watch the test from behind a window. The lab, at Beacon, N. Y., is working to improve jet fuels and lubricants.

Mosquitoes Made Radioactive

THE pesky mosquito is being made radioactive at the University of California so its habits and flight can be studied. Larvae are placed in a solution of radioactive phosphorus so they absorb some of the chemical. At maturity mosquitoes are released, then captured in light traps spaced up to 10 miles away. Above, Geiger counter tests solution.



Spring Smooths Bike Ride

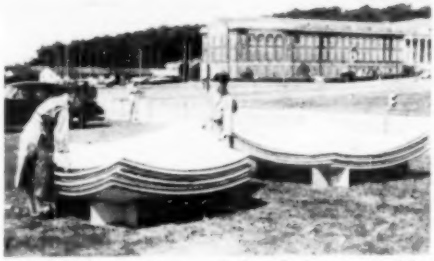
A TWIST of the dial on this new coil-spring bicycle accessory allows you to adjust the tension for a better ride. If you are a lightweight, or riding on a bumpy road, you loosen the spring to smooth the ride. A heavyweight tightens the spring on even pavement. The Huffman Mfg. Co., of Dayton, Ohio, makes the accessory.

This portable, dome-like field shelter for housing military personnel and equipment is made of Fiberglas-reinforced plastic, a lightweight material that is said to be stronger than steel or magnesium. It resists heat, cold, moisture, and fungus. Shelters come in sizes from seven to 30 feet.

Glass-Plastic "Igloo" Is Stronger Than Steel

PORTABLE field "igloos," made of Fiberglas-reinforced plastic, have been developed to shelter men and equipment in the armed forces. They are designed for use in both Arctic and tropical climates.

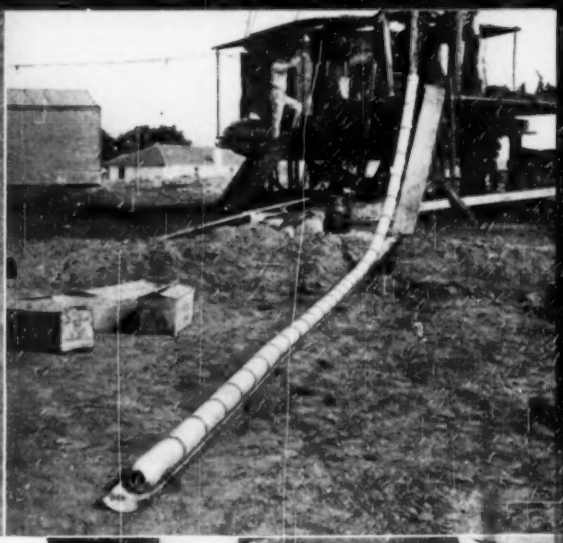
The domes are composed of 12 interchangeable panels, strengthened with criss-cross ribbing. Gaskets and clamps lock the 57-pound panels together. The shelters range in size from seven to 30 feet and can be set up singly, or joined with others to provide a larger protective covering. East Coast Aeronautics, Inc., of Mount Vernon, N. Y., makes the domes.

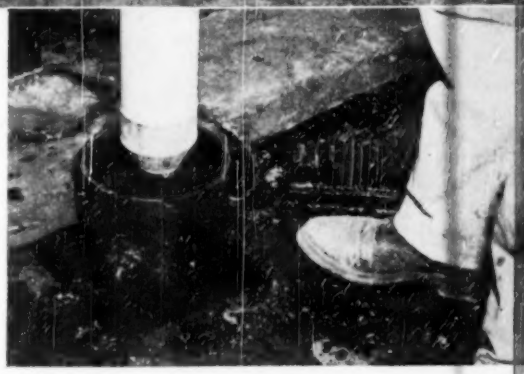


Stacks above show a shelter before assembly. Composed of 12 interchangeable panels ⅜ inch thick, a 20-foot shelter can be erected or dismantled by three men in about 45 minutes.

Panels have ribs for reinforcements, as shown inside partly assembled "igloo," above. Flexible gaskets and clamps at panel edges make a shelter air- and water-tight.

The last panel is about to be put in place above. Windows and ventilators can be built into the shelter, if needed. A 20-foot dome accommodates 20 men under field conditions.





Safe Explosive Taps Oil

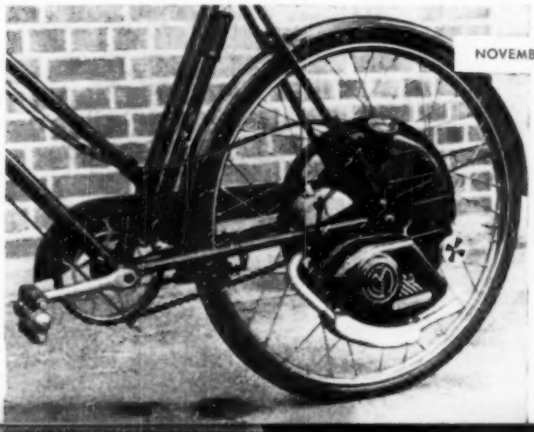
When accident befalls an oil-well shooter's nitro truck, the traditional story ends, "And all they ever found of the driver was his teeth—six miles beyond the county line." A new oil-well explosive containing no nitroglycerine, DuPont's S.O.W.E. No. 1, may make such stories out of date. It can only be exploded by a detonator. Cartridges are threaded on a steel cable (above) and the string (above, right) is pulled up by a derrick and lowered down a well casing (right) to puncture the casing and bring in oil.

Motor Wheel for Bike

Remove the rear wheel of a bicycle, substitute the Cyclemaster wheel shown below, and you have a self-propelled motor bike. Weighing only 20 pounds complete, the British-made motor wheel contains a ½-hp. engine and its 2½-pint gasoline tank. A chain drive transmits power through a clutch to the wheel. Throttle and clutch controls are attached to the handlebars.

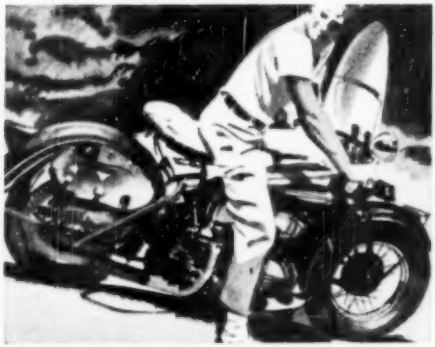
Load Tossed Over Shovel

A new power shovel tosses its load "over its shoulder." Instead of swinging sideward, the scoop leapfrogs the operator's cab (dotted arrow in picture), and dumps into a truck backed up behind. Originally designed for mining, the machine is finding wider use. In the picture, it is removing Belgian blocks from a bridge pavement, and has just filled the departing truck.



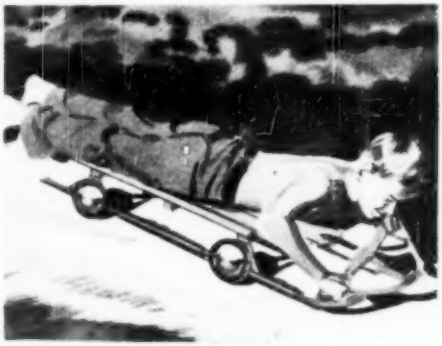
I'd like to see them make . . .

Everyone has his own pet idea of some gadget he would like to see in general use. What is YOURS? Popular Science will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.



A very slow reverse gear on heavy motorcyles, driven through a fluid coupling. It would help when you "walk" the machine backward up slight grades or park it on crowned roads.—*Roy McGuckin, Ridgewood, N. J.*

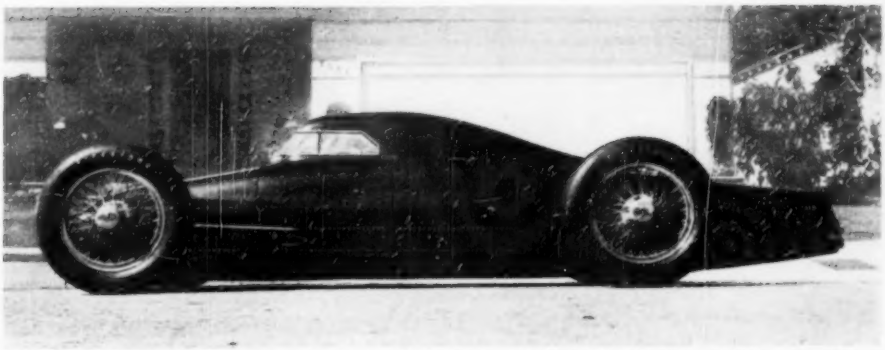
A rubber sink stopper with beads on the underside to fit into the holes in the strainer. These beads would prevent the strainer from shifting when you're washing dishes or clothing in the sink.—*C. A. E. Archer, Maywood, Ill.*



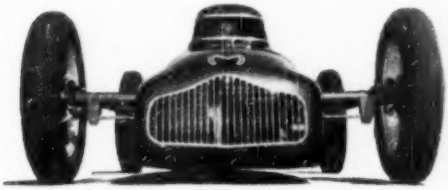
Wheels for children's sleds and the necessary equipment to attach them and to link the front wheels to the steering bar. This would make sleds usable all year round instead of only on snow.—*Wayne Burrier, Hershey, Pa.*

An insulated compartment built into automobile trunks to hold butter, milk, frozen foods, and cold drinks. Fine for campers and for shoppers not returning home from stores immediately.—*Mrs. G. Layden, Greenport, N. Y.*

Defroster slots on front doors of cars to keep side windows clear. The hot-air ducts could be connected to the windshield defroster system by a tube and rubber gasket at the door hinge. —*Donald M. Day, Ironton, Ohio.*



Waist-high hot rod clears ground by only 2½ in. It weighs 1,000 lb., has 105-in. wheelbase.



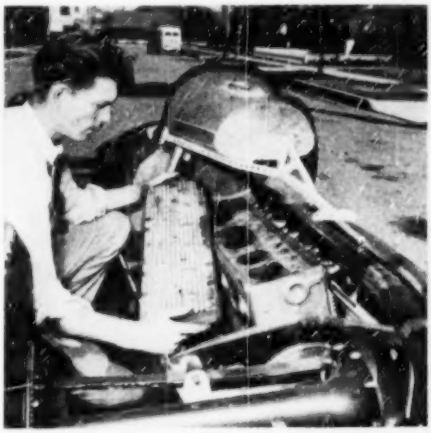
Homemade Racer Hugs the Road

A ROCK no bigger than your fist would rip a gash in the bottom of this road-hugging hot rod—that's how low it is. It clears the ground by a scant 2½ inches.

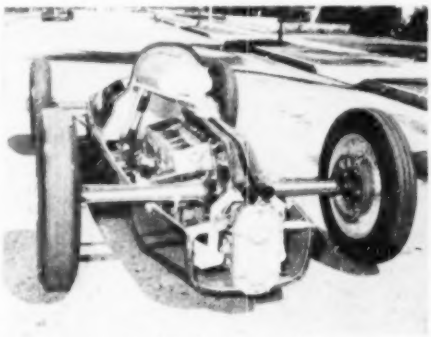
Eddie Miller, Jr. built the sleek racer in his garage-workshop at Culver City, Calif., with the help of his father, Eddie, Sr., an old-time Indianapolis driver. The car is so low it can be driven over only the smoothest dry-lake time traps in Southern California, where Eddie expects it to hit better than 150 m.p.h.

The engine, a modified six-cylinder '49 Pontiac, has a special head and pistons that Miller cast himself. The power train runs back from the rear-mounted engine and under the rear axle to an aluminum-housed roller chain, and then forward to the differential. The frame is welded steel tubing and the body is sheet aluminum. A Plexiglas canopy shields the driver at high speeds.

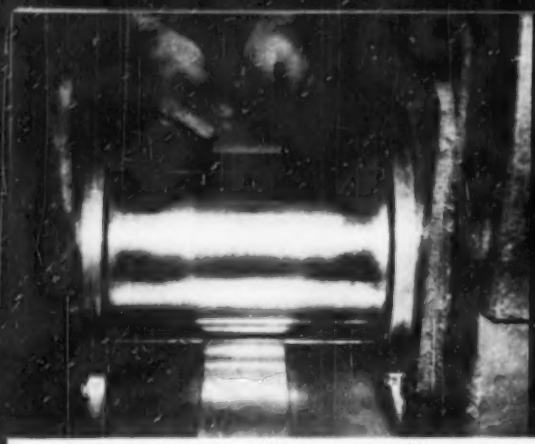
A small radiator core, scavenged from an airplane oil cooler, is mounted in the nose. The big wire wheels are from two '29 Hupmobiles. The car is painted a dark golden bronze—"beer-bottle brown," says Miller.



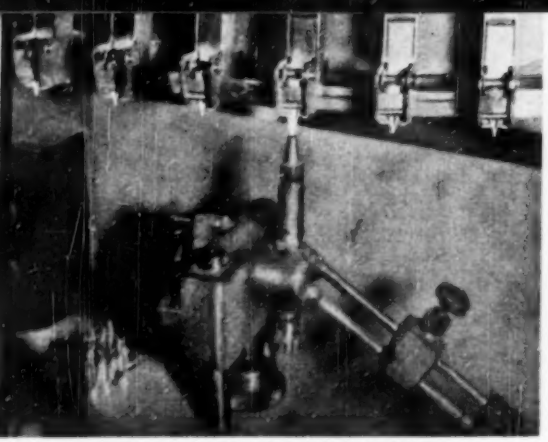
No waste space here. Rear-mounted engine is shoehorned into narrow afterbody. Redesigned head boosts compression to 7.5 to 1. Tank snugged in behind headrest holds cooling water.



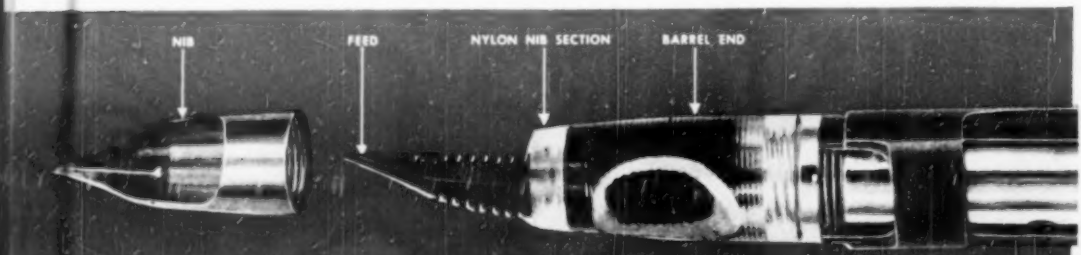
Aluminum-panel body is removable in sections. Engine develops 200 hp. at 6,000 r.p.m., has four carburetors and two ignition systems. Transmission is Model-A Ford, with 2.92-1 top gear.



Pen points are made from 14K gold, squeezed into sheets by small rolling mill. Point, or nib, passes through 95 separate steps, mostly by hand. Ink doesn't corrode gold.



Nibs are tipped with hard osmiridium alloy. Tipped nibs pass through flame at 1,900° F. Gold melts and flows around tougher osmiridium, firmly bonding the tip to the nib.



How Your Fountain

By John F. Loosbrock

EVERY time you sign a check or write a letter with a fountain pen, your fingers hold a mechanism that reflects the combined skills of hundreds of trained workmen.

The modern fountain pen was born around the turn of the century, when an Iowa jeweler lost patience with the clumsy writing devices he was selling. Most of them had to be filled with an eye dropper and all were messy to handle.

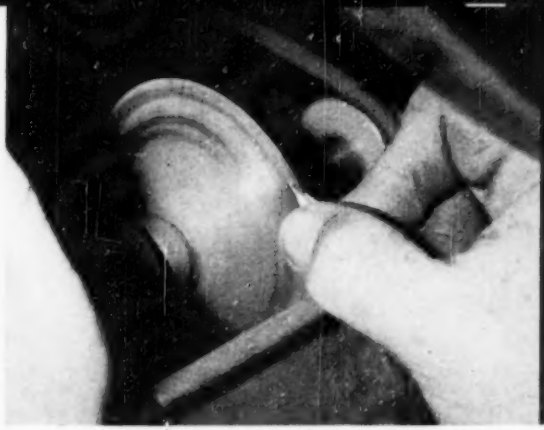
So W. A. Sheaffer began tinkering in the back of his shop and in 1908 came up with the lever-filling pen. He handmade a few to test the market. They sold so quickly that he later went into full-scale manufacture.

I learned all this when I visited the big Sheaffer plant, which still occupies the original site on the Mississippi at Fort Madison, Iowa. And I learned a lot more about how a fountain pen is put together.

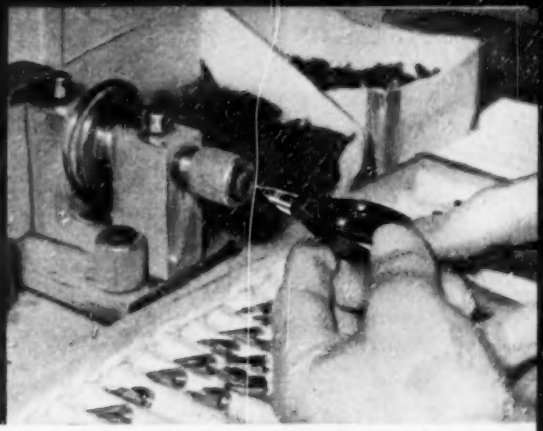
I learned, for example, that it takes six weeks and 318 separate operations to make a fine pen. That the list of raw materials includes plastics, gold, silver, copper, steel, brass, and a dozen others. And that the secret of a good product is the 25 percent of manufacturing time spent on inspection.

Heart of a pen is the gold "nib," or point. You can't have a good pen with a poor point. And only gold will do, since it resists the corrosive action of ink better than any less precious metal.

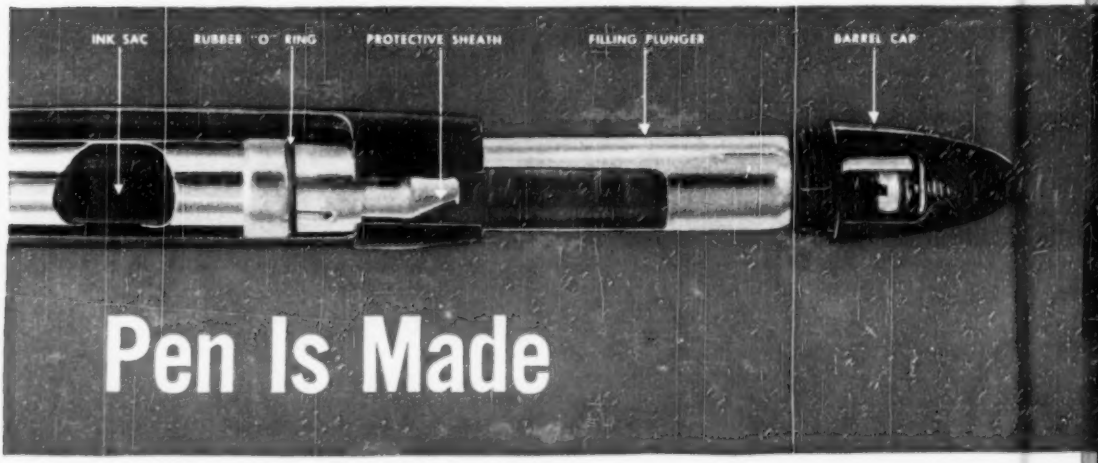
The nib begins as a sheet of 14K gold drawn into a seamless tube. The pointed end is heavy, for stability. The opposite end is also thick, since it will be threaded for



Slitting the nib is ticklish handwork. Point is pressed against a thin copper disk revolving at high speed. Abrasive "mud" of glycerin, carborundum, and water aids cutting action.



Final assembly of point unit. Gold nib, hard-rubber feed, and a nylon-plastic section that binds nib to barrel are fitted together loosely, then inserted in rapidly revolving sleeve to tighten them.



Pen Is Made

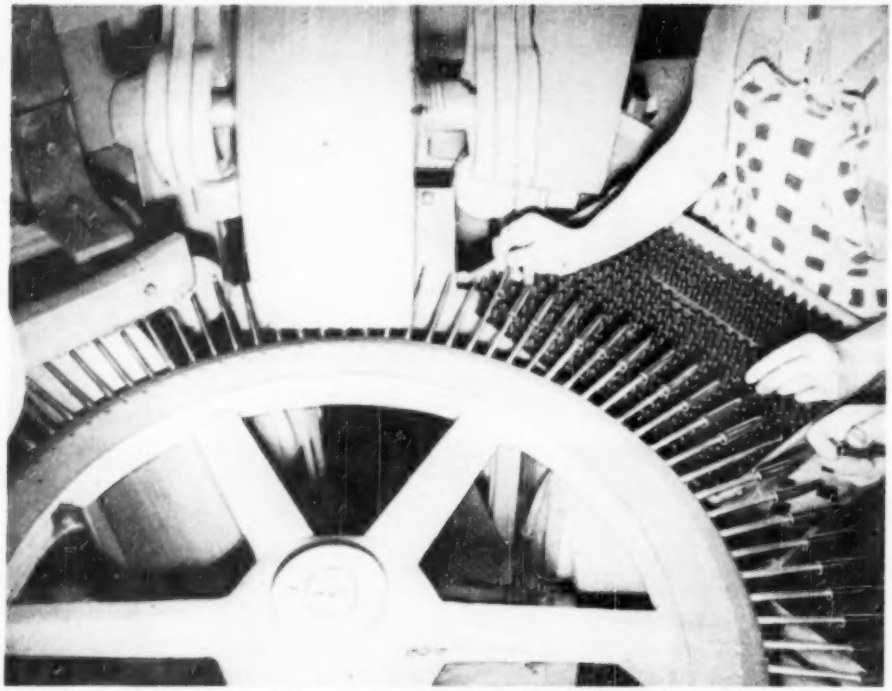
assembling. In between, the thickness varies according to the flexibility that is wanted.

The nib is tipped with an alloy of osmium and iridium, two of the hardest metals known. Skilled craftsmen split it on a copper wheel. Then it is ground by hand on a copper cylinder charged with carborundum.

No mechanical substitute has been devised for the delicate work involved in turning out Sheaffer's 16 standard points, ranging from the accountant's hairline to the executive's flourishing stub. Secretaries can buy a special shorthand pen, with the symbol for "shorthand" stamped on the barrel. For composers, there's the flexible, three-pronged nib they need for writing music.

Expensive gold is salvaged and sold through an ingenious program. Each night a tremendous suction unit pulls the gold

About 25 percent of all manufacturing time is spent on inspection. This final white-glove once-over puts the seal of approval on finished pen before labeling and boxing for shipment.



Automatic buffer revolves barrels and caps under wheel that uses jeweler's rouge to bring out high gloss. A similar machine gives pens a final polish with high-luster waxes.

dust out of the air, sifts it through cloth bags, and shakes it down. Workers wear aprons, which are laundered on the premises. The wash water goes through a series of settling tanks and the residue is burned. Rags, paper, and floor sweepings are burned and the gold recovered from the ashes. So are floor boards when they're replaced. Sheaffer's saves an estimated $100,000 worth of gold a year this way.

Barrels and caps are molded from hot thermoplastic, squirted under 28,000 pounds per square inch of hydraulic pressure into multiple dies. Centerless grinders taper the rough plastic cylinders to the desired proportions. Then they're buffed and polished to a high luster on automatic machines.

Meanwhile, in another department the filling mechanism and rubber ink sac are assembled and fitted into the barrels as they pass along the assembly line.

Another key component is the cone-shaped piece of hard rubber, called the feed, that fits under the point. Its hidden holes and channels feed ink by capillary action. The larger the feed's capacity the less likely a pen is to leak.

The assembly department puts together the finished pen. First, the nib, the feed, and a section of nylon plastic that holds barrel and nib together are fitted into a compact nib unit. This is screwed into the barrel with a special thread seal to make a leakproof joint.

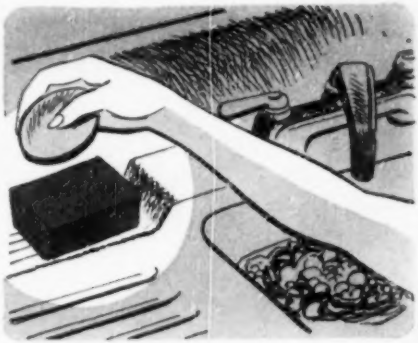
The nib itself has to be fitted just right or the pen's no good. The rubber feed is heated slightly and molded to fit the small variations in the nib. The nib must be perfectly aligned.

After the pen has been assembled, a smoothing operator "writes" with it on fine emery paper treated with jeweler's rouge, polishing the osmiridium-alloy tip to a mirrorlike finish. As a double check, the point must pass an electronic smoothness tester and the eye of a trained inspector who writes with it on bond paper.

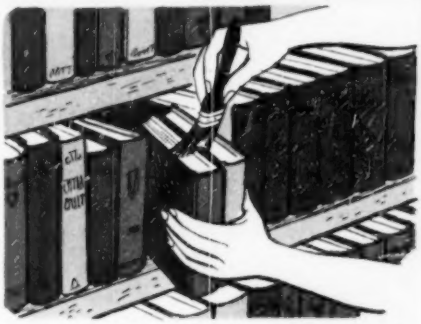
After more buffing, polishing, and inspection, the pens are tagged and boxed for shipment. END

Keeping the Home Shipshape

Your mixer cover won't get mislaid or in the way if you hang it from a hook above the shelf where you keep the mixer. Simply lift the cover to withdraw the mixer or replace it.



A small rubber sponge makes an excellent soap dish for the kitchen. The sponge holds the drippings from wet soap and can be used for soaping the sink after dishwashing.



To dust the tops of books quickly and easily without smearing them, use a paint brush instead of a dust cloth. A clean, soft-bristled brush about two inches wide works fine.

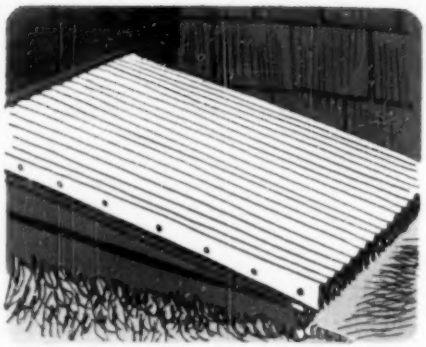
New rugs often shed loose nap for some time. Combing the entire surface of the rug with a large-toothed comb will remove this excess nap. Comb in one direction only.

Pantry and dining-room doors of the swinging type can be kept free of fingermarks and smudges by mounting a 4" by 8" panel of left-over linoleum on each side of the door.

Please turn the page for five more suggestions.

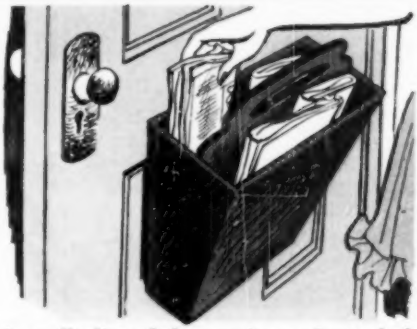
Keeping the Home Shipshape

Spraying the inside and the underside of your garbage can with automobile undercoating will protect it against rust and corrosion from moisture and acids.

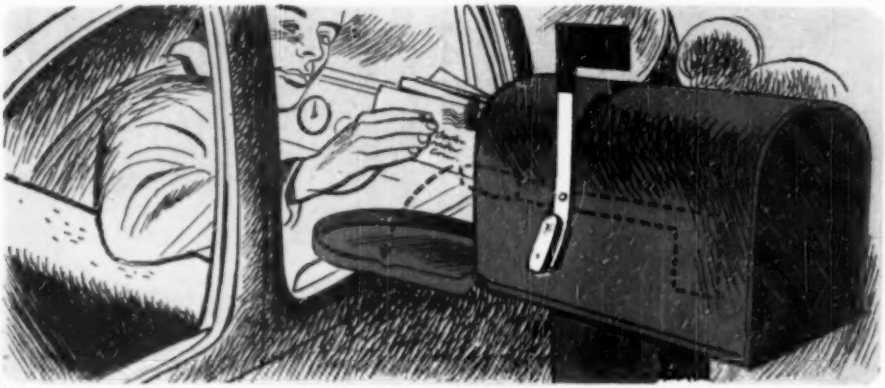


Covering an outside cellar door with aluminum roofing will reduce repair bills. Bend the sheets over the edges. Nail at the top, along the joints, and sparingly at the bottom.

Your bathroom or hall mirror can serve as an excellent memo pad. Messages may be written on the glass with a china-marking pencil. Soap and water will remove the writing.



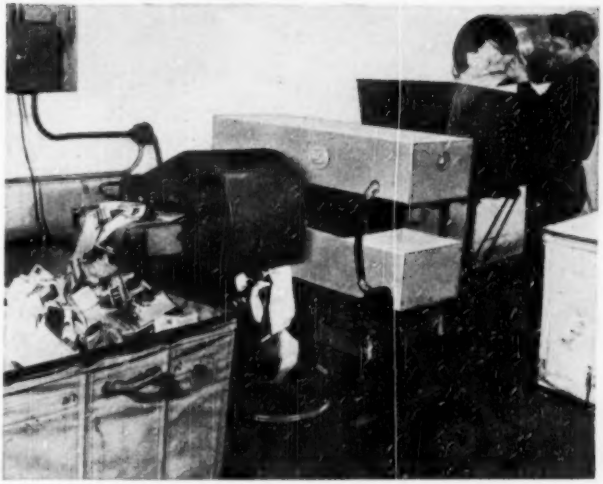
A small, discarded magazine rack attached to the back of a kitchen or pantry door makes a handy receptacle for paper bags and wrapping paper. Remove the legs before hanging it.

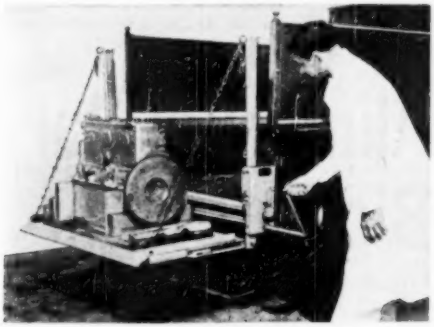


Make your mailbox flag automatic by cutting a new one with a long arm that has one end weighted. Notch the door to fit weighted end. When the door is opened, the flag goes up.

Gadget Gulps Mail and Spits Change

NICKELS and dimes you send in with box tops and wrappers for premiums can't get lost when the mail is processed by the machine at right. It spots envelopes containing coins—by changes the metal causes in an electromagnetic field—and blows them into a drum (center). Papers with no coins pass through to the basket at left. Associated Activities, Minneapolis advertising service organization, uses the RCA device.





Truck Gate Is One-Man Lift

LIFTING heavy loads into a truck becomes a one-man job with this hoist. Easily attached to the tail of a small truck, it can handle weights up to 600 pounds with its hand crank and ratchet system. The load platform folds up, forming the truck's tailgate. Ven Corp., Los Angeles, makes it.

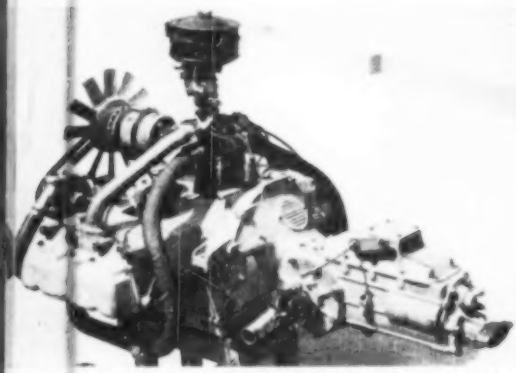
Pencil and Paper in One Unit

THIS new pencil carries its own memo pad—a 36-inch roll of paper inside the barrel. Turning the pencil cap exposes the edge of the paper, which can then be pulled out and torn off. The Mem-O-Riter, which can be used to store stamps instead of paper, is made by A. H. Walter Co., New York.

Spring Fork Eases Bumps

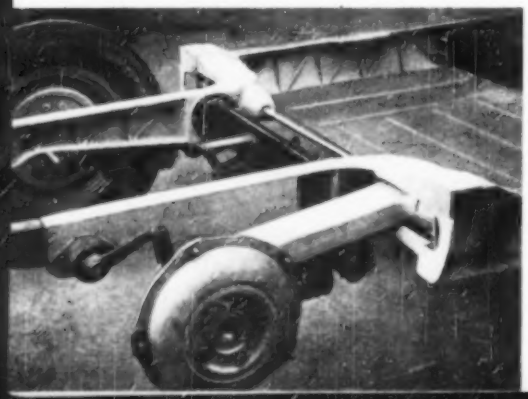
A TELESCOPING fork irons out road bumps for the new 1951 Harley-Davidson lightweight motorcycle. It has a long spring and an oil-retaining synthetic-rubber boot, as shown cut away in photo at right. It also has more horsepower, thanks to a redesigned, longer muffler. H-D's bigger cycles also have been improved—the two-cylinder Big Twin has chrome-plated compression piston rings. Hydraulic brakes are provided on the three-wheel Servi-Car.

That American look—fresh from France. Big and roomy, this new all-aluminum Hotchkiss Gregoire has a front-seat width of 59 inches, gets 29 miles to the gallon, and will be priced low.



Small, compact engine has four cylinders grouped horizontally in opposed pairs, develops 64 hp. at 4,000 r.p.m. Note how power train doubles back from gearbox to take-off in center.

Rear wheels, like front ones, have independent coil-spring suspension. Wheels, consisting only of tire and thin support ring, bolt onto oversize hubs to lighten weight, speed changing.



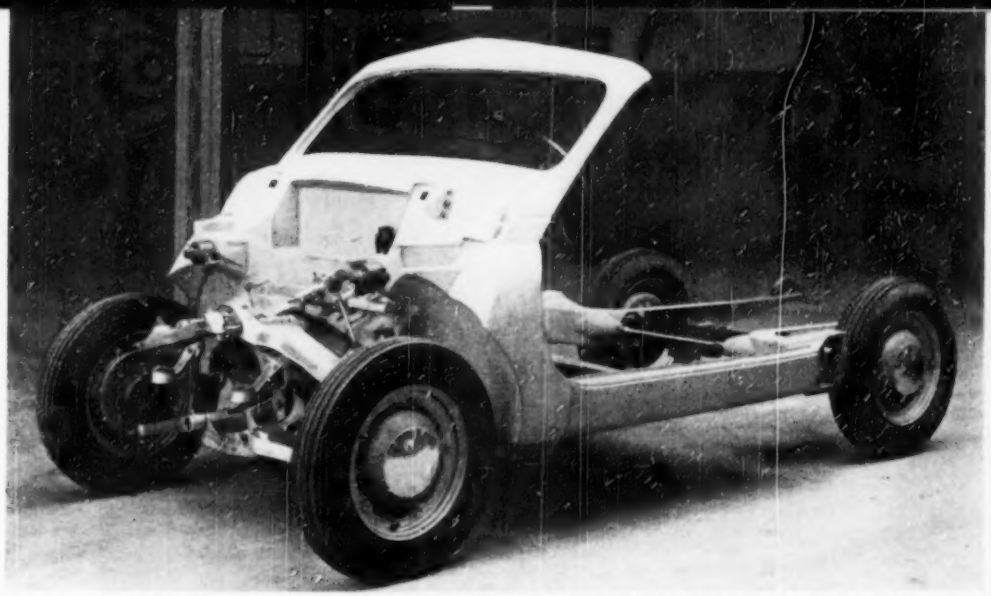
Aluminum Car Big But Light

U.S. MOTORISTS who tend to think of low-priced foreign cars as midgets will be in for a surprise when they see this full-size, American-looking Hotchkiss Gregoire, due to go into production in France this winter.

And they'll be in for another surprise, too, for the spacious, five-passenger, four-door sedan is made almost entirely of aluminum. The chassis, firewall, and windshield frame are cast from aluminum alloy and form a single unit. The body is made from sheet-aluminum stampings. Even the crankcase and brake drums (except for steel liners) are aluminum.

The result is a drastic cut in weight—the car weighs 2,090 pounds, nearly 1,000 pounds less than the average low-cost American car. And that means fuel economy—29 miles to the gallon at 50 m.p.h.

Another notable feature of the French newcomer is front-wheel drive with the entire engine placed ahead of the wheels. The power train runs back from the engine to



Cast-aluminum chassis, firewall, and windshield frame form single assembly. Moving back front wheels to accommodate forward-mounted engine accounts for short, 96-in. wheelbase.

the gearbox behind the wheels, then does an about-face and returns to the take-off point midway between the two. Placing engine weight ahead of the wheels improves road handling, according to the car's designers.

All four wheels have independent suspension, with coil springs operating in tension, instead of the customary compression.

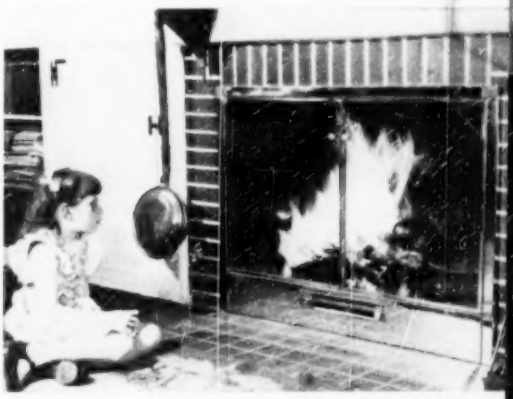
As yet, no price tag has been put on the new car, but it is expected to compete with American cars in the low-price field. END

Transparent Shoes Test Fit

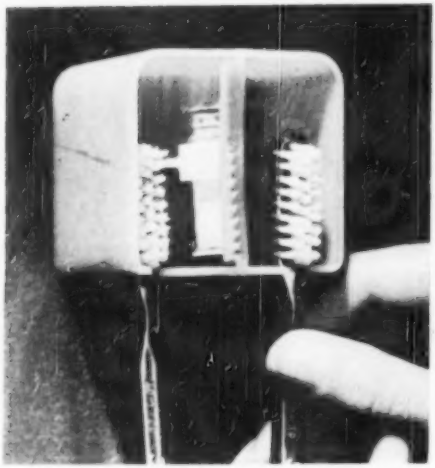
THE new clear-plastic "try on" shoe below lets you see exactly how a shoe fits before you buy its leather equivalent. A red danger line marks the point beyond which a foot should not extend for proper room for growth, important in children's shoes. Visual Shoe Fit, Inc., of Rochester, N. Y., makes the shoes in 104 sizes.

Glass Screen Guards Fireplace

THIS new glass fireplace screen lets heat radiate out but keeps smoke, soot, and flying sparks in. Its two doors of heat-tempered Herculite glass can withstand up to 650° F. An adjustable vent at the base of the brass frame permits control of the fire's draft. The Thermo-Rite screen is made by Galanot Products, of Alliance, Ohio.



Aids to Modern Living

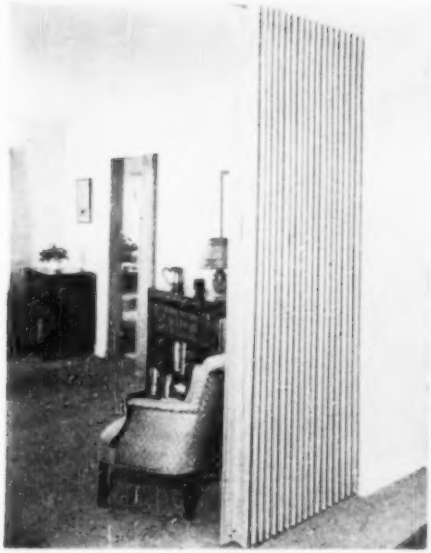


Toothbrushes Protected from Germs. With your brushes inside this new plastic holder, germs don't have a chance. Crystals in a small bottle, good for a year, kill them. And there's a pivoting front door to keep out dust and dirt. Priced at $1, the Sanit holder is made by the Universal Devices and Sales Corp., of Tacoma, Wash.

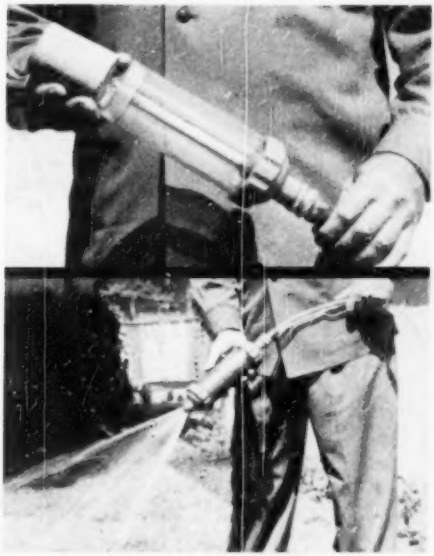
Water Jets Clean Dishes. A spinning metal tower in this new Youngstown dishwasher aims swirling jets of hot water at dishes, as shown in inset, cleaning them in 10 minutes. An upper basket holds cups, glasses, silverware; a lower one, larger dishes. The combination dishwasher and sink above is priced at about $350.

Hood Aims Shower. A woman won't splash a hairdo if she snaps this plastic shield over the shower head. A flip of the finger makes angular adjustments that direct the water spray exactly where it is wanted—high or low. Made in several colors, Aquashield is sold by Charles Gemora Enterprises, of Los Angeles, Calif., for $1.

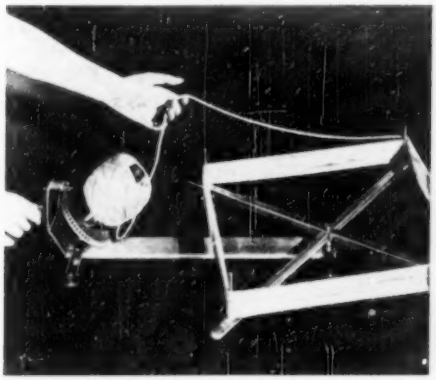
Cord Dispenser Cuts Too. There's no tangled twine with this plastic holder, which houses a 375-foot ball of strong cord. For easy cutting, a plastic side case holds a razor blade with the edge exposed in two small grooves. The cord feeds from a hole in the top of the container, priced at 75¢ by the J. E. Fricke Co., Philadelphia.



Doors Fold Like Accordion. No swinging doors to take up space with these accordion-folding doors. The metal-framed, fabric-covered doors can also be used as partitions. Modernfold Doors, made by New Castle Products, Inc., New Castle, Ind. and previously available to contractors, can now be installed by amateur carpenters.



Lawn Hose Spreads Fertilizer. You can water your lawn and fertilize it at the same time with this hose attachment. The plastic cylinder (top) is filled with two cartridges containing nitrogen, potash, and phosphorus, and the water carries the chemicals into the ground. Leon's Horticulture Specialties Co., Glendale, Calif., makes it.



Yarn Winder Saves Time. You can wind a 240-foot skein of yarn into a neat ball in two minutes with this new winder. The yarn is placed over adjustable pegs in a cross, threaded through an eye, and attached to a spindle. Turning a crank then rotates the spindle and rolls up the yarn. Jo-Bell Products, Chicago, sells the winder for $2.98.

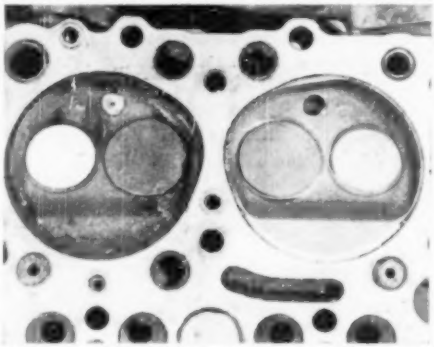
Clothes Brush Fits Purse. No excuse for shabby shoes or clothes if you carry along this new purse-size brush. Only three inches long, it's made of spongy, latex-impregnated wool that picks up dirt and lint from hard-to-clean materials like suede and serge. Made by Robert W. Lehrfeld, Inc., New York City, the Brushoff sells for 50¢.

Mechanic holds rice that is fired from the tank above to remove carbon from an auto engine.

The tank's hose nozzle is inserted, above, into the spark-plug opening of a combustion chamber.

Rice Fired from Tank Chips Carbon Off Engine

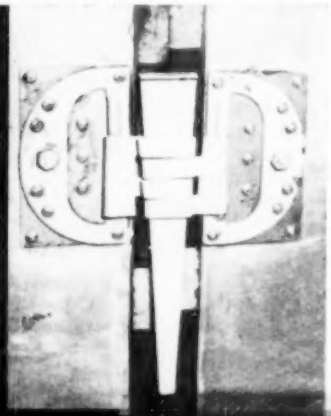
WITH ordinary rice as ammunition, a new blasting gun scours the carbon off a car's combustion chambers, without taking off a cylinder head, in one fourth the time it takes to do the job by hand. The carbon blaster forces rice, under 40 to 60 pounds of pressure, into each cylinder through a plastic hose from the base of a tank, then draws out the grains for re-use through a hose at the top. The hoses are connected to a nozzle that is worked up and down inside a spark-plug opening. Oldsmobile engineers developed the machine.



Result: Chamber at left above is still coated with carbon; one at right has been blast-cleaned.

Aluminum Prefab Protects Soldiers in Arctic

THIS new portable, knockdown prefab keeps Arctic-stationed soldiers at a cozy 70° F. inside while 100-m.p.h. winds at sub-zero temperatures rage outside. Developed by Army Engineers, it has aluminum side, floor, and roof panels with honeycomb cores of kraft paper for strength and insulation. Units are 8 ft. high, 20 ft. wide. Length can be any multiple of 8 ft. Wedge-shaped pins (right below) hold parts together.



MECHANICS and HANDICRAFT
REG. U. S. PAT. OFF.

The Truth About

Tiling a Floor

Would a resilient asphalt floor improve your basement? You can lay it yourself —but read this article before you do it.

By Henry Morton
(whose new floor is pictured here)
PS PHOTOS BY HUBERT LUCKETT

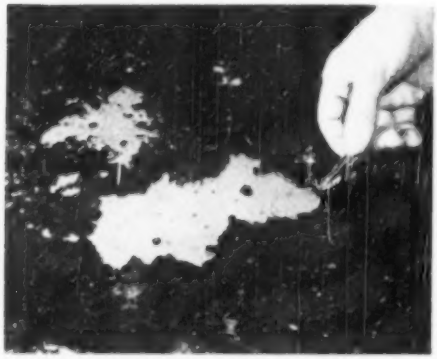
HOW TO ORDER MATERIALS

Allow for breakage and wastage when ordering tiles. If design calls for a separate border, add 1 percent to the area to be covered before figuring number of tiles needed. In designs having no separate border, add 14 percent to the total area if it is less than 50 sq. ft., 10 percent if it is between 50 and 100 sq. ft., and 7 percent if it is between 100 and 300 sq. ft. Consult your dealer.

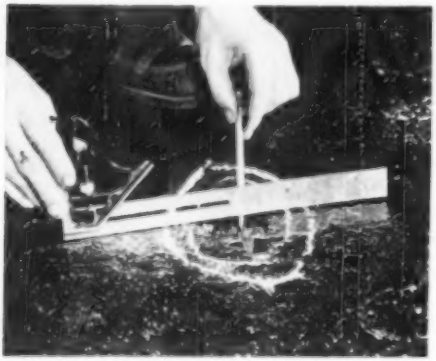
I DECIDED several months ago to get more use out of my cellar by putting down a resilient tile floor. I've done it now and it has improved the appearance and value of my basement considerably. But I wish that I had known as much when I started as I know now about laying such a floor.

I knew that there were different kinds of tile—asphalt tile, linoleum tile, rubber tile, plastic tile, and cork tile. But I didn't know that only asphalt or plastic tile is suitable for

1. Primer coat must be put on a day or so before you plan to lay the tile. And before this is done the floor must be properly prepared to receive it. This is extremely important.



2. Here's what happens if you don't remove all paint from the surface of the floor. The primer does not penetrate into the concrete and can be peeled off. This primer had to be removed.



3. Holes like this should be filled with quick-setting cement before applying the primer. The author did not heed the experts' warnings and had to do part of the work over again.

use on floors that are on or below a grade. Fortunately, I chose asphalt tile (Armstrong's, as a matter of fact), and we're quite pleased with it.

Then I bought the kit pictured below, containing the basic tools—a notched plasterer's trowel, an awl or scriber, a chalk line,

and a tape measure.

I added the 98-cent mail-order-house folding rule simply because I've never been very handy or accurate with a tape measure. This ran my investment in tools up to $1.98. But nobody offered to sell me two other things that I needed very badly—patience and care.

Preparing the Floor

The most important part of the job, I found, is not laying the tiles but preparing the floor. The tiles go into place easily and amazingly fast, but getting a typical concrete cellar floor in shape to receive the primer, then the cement, and finally the tiles, takes time.

Asphalt tiling tends to shape itself to conform to the contour of the floor. Hence, any cracks or holes in the concrete must be filled with a quick-setting cement, and peaks or high spots must be chipped or sanded off. The smoother the surface of the floor before the primer is applied, the smoother the finished tile floor will be. Any imperfections that you leave will show through, eventually if not immediately.

If there is any paint on the floor, it must be completely removed. Otherwise, the primer—which is designed to provide a bond between the asphalt cement and the concrete—will not stick to the concrete.

My Big Mistake

The quickest way to remove paint, I found after numerous experiments, is to spread sawdust over the area, saturate it with a water solution of lye, and leave the

4. To find center and square the area to be tiled:

a. Measure all four sides of basement.

b. Mark centers of the two short sides.

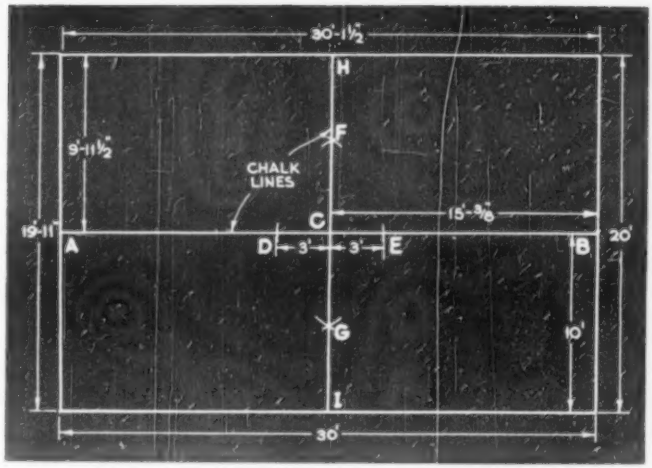
c. Strike chalk centerline (AB in sketch).

d. Mark center (C).

e. Using folding rule, swing 3' arcs from C to get D and E.

f. Using D and E as centers, swing intersecting arcs to fix Points F and G.

g. Strike second chalk line (HI) through points F and G and center (C).



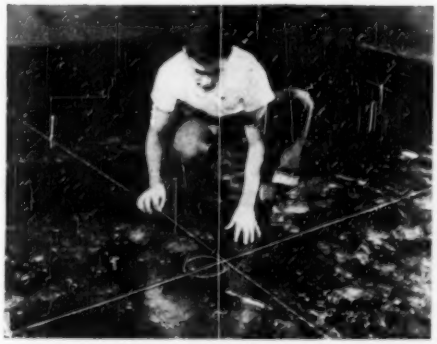
mixture in place overnight. The next morning the sawdust and lye, together with the paint, can be washed off with water and a cloth or flushed off with the spray from a garden hose. Since lye can burn the skin, you should wear rubber gloves for this operation. Then, after the surface has been thoroughly cleaned, it should be washed with a mild solution of vinegar and water to neutralize any alkalinity left by the lye.

In my hurry to get started, I spread the primer over some small spots of floor paint that, at the moment, didn't seem worth removing. But when the primer coat had dried, I found that it could be peeled off in sheets wherever there was paint. So I had to remove the primer coat with a gasoline-soaked rag—not a pleasant or a particularly safe job even in a well ventilated cellar—and then remove the paint before applying more primer.

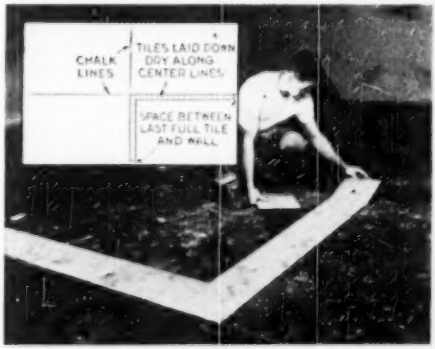
The Primer Must Stick

Concrete floors that are sandy, or that tend to flake off easily when tapped with a hammer, must be covered with a topping to provide a solid, smooth surface for the tile. The topping material recommended by the manufacturer of the tile you choose is likely to be best. It usually consists of a mixture of cement, sand, water, and a prepared asphalt emulsion. Your dealer will give you the correct proportions and you can mix it yourself.

If you suspect your cellar floor has been treated with a hardener or curing agent, test it by spreading primer over a small area

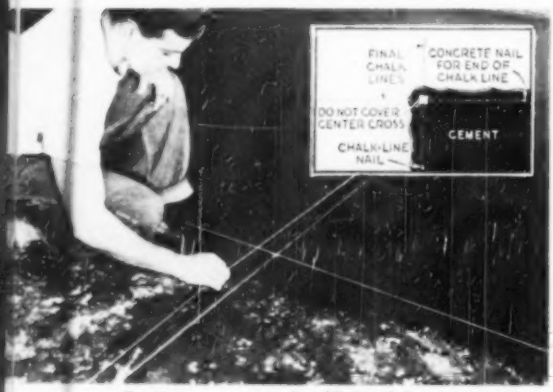


5. **When striking** the chalk lines, be sure that the line is well chalked and pulled taut. Snap the line several times to get distinct chalk lines on the black coat of primer.

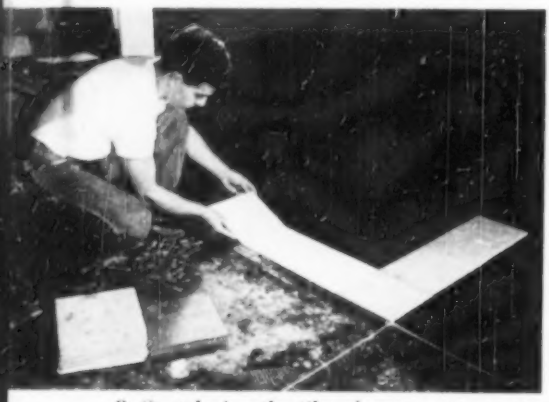


6. **Place two rows** of tiles along the lines to check layout before putting down the cement. This will show whether one of your lines should be shifted to permit use of wide pieces at edges.

7. Spread the cement thinly and evenly with a notched plasterer's trowel. Use broad, sweeping strokes and try to hold the face of the trowel at a right angle to the floor surface.



8. Center cross should be left uncovered so that it and what remains of chalk lines can be used to strike in new chalk lines on the cement after it has become tacky.



9. Start laying the tiles along your two center lines. Plop each tile into place rather than try to slide it in. If you slide it, you may squeeze cement up between two tiles.

first. If the primer does not stick to the cement, roughen another small area with a wire brush and spread on more primer. And if the primer still won't adhere, you'd better give up your dreams of a resilient tile floor.

The primer coat can be applied to the floor with the smooth edge of the notched trowel, which I found to be best, or with a broad brush or an old broom.

Finding the Center

Once the primer coat has dried (this usually takes about 24 hours, but took a bit longer on my floor), the next step is to square the area. This can be done by using a folding rule and chalk line to find the exact center of the floor and then checking how the tiles will fall by laying them down dry. My basement, I found, is not truly rectangular and I'm told that few basements are.

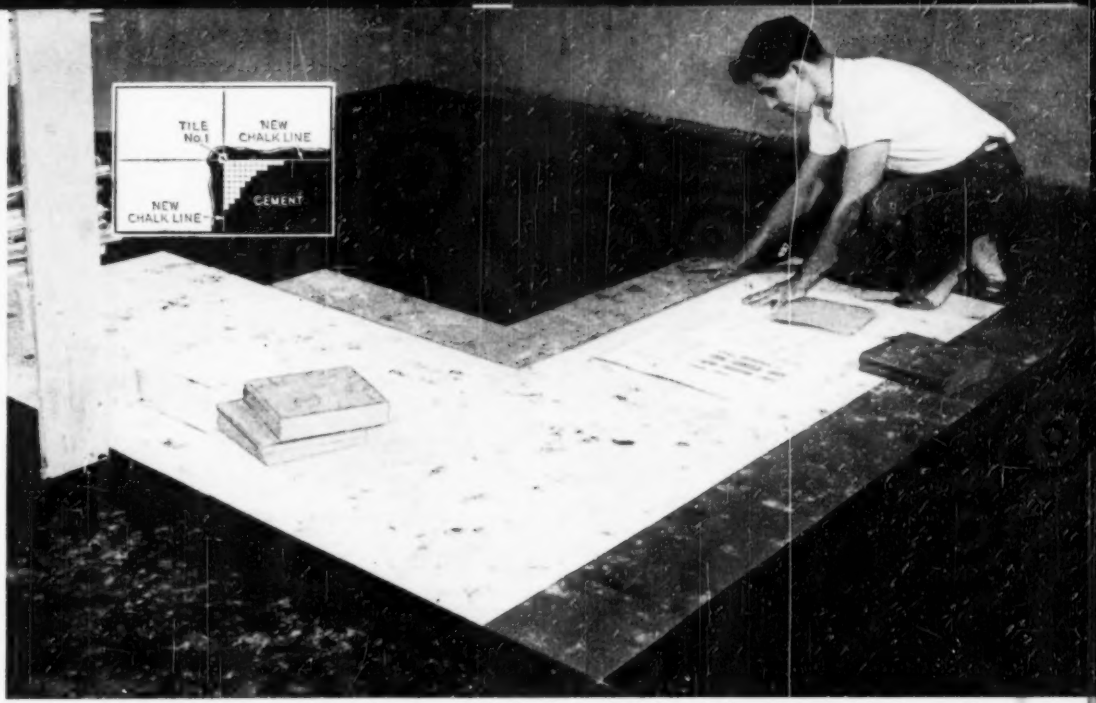
Allow for at least 2 inches of tile but no more than 8 inches between the edge of the last tile and your wall (unless a full tile will fit perfectly, which would be unusual). To do this, you may have to shift one chalk centerline one way or the other. Shifting it one-half the width of a tile (4½") is a simple way to make the edges on both sides of the room come out nicely.

When you have this geometrical problem worked out, you can proceed to apply the asphalt cement and lay the tiles. A little bit of cement goes a long way. To spread it, press the notched edge of the trowel against the floor and keep the blade at a right angle to the floor. Then work it out evenly with broad sweeping motions. If anything, too much cement spread on the floor is worse than too little.

My dealer told me that it's a good idea to work on only a quarter of the floor at a time. So I spread the cement in a thin coat over slightly more than a fourth of the floor, being careful not to cover the cross of the chalk lines at the center. Then when the cement had become tacky (about 45 minutes later in my case), I used the center cross and what was left of the original chalk lines to strike new chalk lines on top of the cement.

Plop Them In

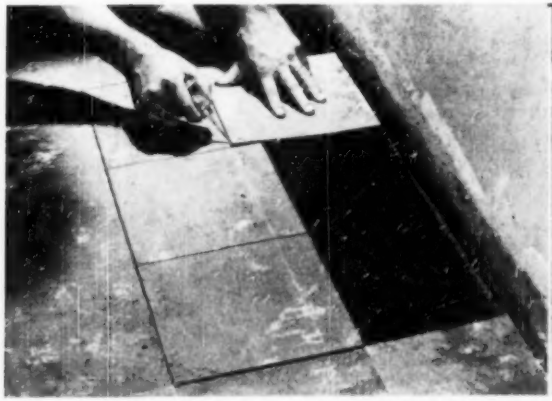
This gave me guide lines for laying the first two rows of tile at right angles to each other. From there on out to the last tile before the wall, it was just a question of building out pyramid fashion—butting the edge of each new tile against one that already was



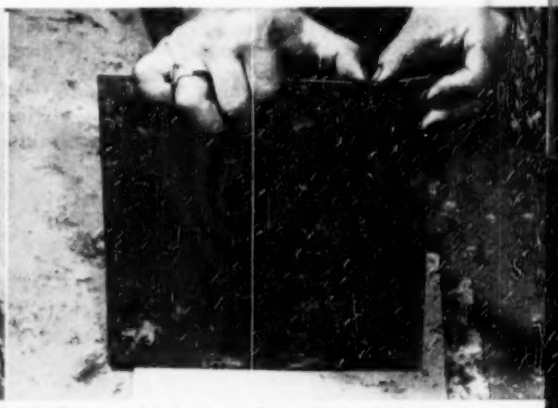
10. Build out toward the walls, pyramid fashion, paying close attention to your design. Butt the edge of each tile against one that is already in place and set it firmly in cement.

laid and plopping it firmly in place. If you try to slide a tile into place, you are liable to mess the job up by squeezing cement up between the two tiles.

When the four quarters of the room were laid, I was ready to install the border tiles. The simplest way to measure and cut them to fit, I found, was to place the tile to be fitted directly over the last tile in the row and then place another tile over it with its edge flush against the wall. Then using the outside edge of the top tile as a straight edge, you can scribe a line on the tile to be fitted. By going over the scribe line several



11. Border ties can be measured for cutting by placing them exactly over last tile in row and scribing them along straightedge formed by placing a second tile flush against the wall.



12. Tile can be broken along the line left by repeated scribe marks. Author used this method and found that each border tile fitted nicely against the wall of his basement.

times, I could cut deep enough to allow me to break the tile in two along the line.

When measured and cut this way, each border tile will fit nicely against the wall. I used this same method—which is standard—for cutting tiles to fit around the stairs.

Don't Lay Warped Tile

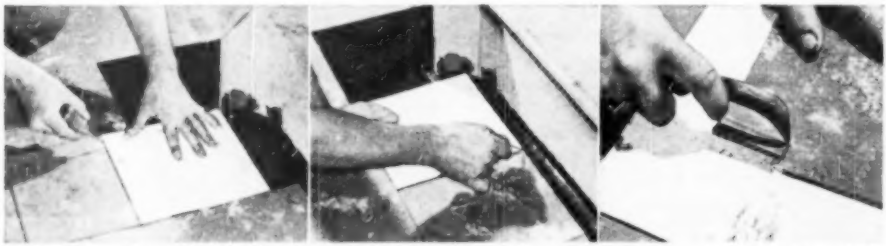
Once in a while, I'm told, you may get a box of tiles that have been warped slightly because of the way they were stored. Don't try to lay them in that condition. Borrow your wife's hot plate and heat each tile slightly before putting it into place. All tiles should be stored in the room where they are to be laid for at least 24 hours, and the temperature of the room should be maintained at least 70° F.

When fitting a tile around a pipe or similar irregularity, I found that if I heated the tile on my hot plate (the kitchen oven would have served as well) I could cut it to fit with metal shears.

Finally, what the tile people call "walking in" is important to the finish of a tile floor. The more traffic it gets right after it has been laid the better. Foot pressure helps to settle the tiles in place. Most tile dealers will advise you to throw a party the night after the floor is completed. I did, and my guests did a grand job of "walking in." END

HOW TO TAKE CARE OF AN ASPHALT TILE FLOOR

- Don't wash it more than two or three times a year.
- Never use strong soaps.
- Sweep or dry mop for cleaning.
- Most soil spots, including those from cement, can be removed by rubbing carefully with a moistened, soap-impregnated steel-wool pad of the type sold for cleaning pots and pans.
- Wax frequently for long wear. Use a self-polishing wax and apply in a thin coat. Fit all furniture legs with flat furniture rests that distribute the weight. THIS IS IMPORTANT. Roller-type casters and dome rests will dent and disfigure asphalt tile. Use large flat cup rests under pianos and other heavy pieces. Never slide a heavy piece of furniture over an asphalt tile floor; carry it.



13. Tile can be cut around such obstructions as stairs or furnace in same way that border tiles are cut. It can be cut cold with a linoleum knife or heated and cut with metal shears.

14. Finished tiling job is shown below. Mothers appreciate a floor that is easy to clean.

Pressure Feeds Paint Roller

THIS pressure-roller outfit can be used to apply oil or water paints, enamel, stains, or sealers. It is available in two models—the one with a hand pump shown here and another one for use with an air compressor. Each model is priced at about $25 by the Electric Sprayit Company, Sheboygan, Wis.

The 3½-gal. tank will withstand about three times the maximum operating pressure and is also protected by a safety valve that pops off at 35 lb. pressure. Another safety feature is the automatic release of pressure before the cover is removed. The unit comes complete with 15 feet of hose.

They're amateur radio operators. He's deploring the practice of some operators who get their licenses (tickets) and immediately engage exclusively in voice operation (on 10 meters). Thus they lose the chance to learn to distinguish perfect key sending (comparable to tape transmissions) from a style of sending developed by operators on Great Lakes cargo ships.

Door Does Double Duty

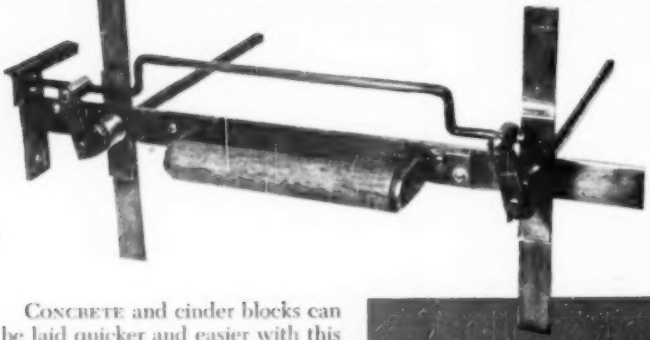
THE door-plus-screen-door setup has always irked me: two doors to open, two doors to slam when closed. When I added another room to my home, I built this combination door and screen door.

Now when I want ventilation, I fold the top and bottom panels over the center one and I have a screen door. When I want a solid door, I swing the panels into place and hold them there with turn buttons.

Two-by-fours, half-jointed at the corners and rabbeted ¾" by 1¼" on the inside edges, made the frame.

The panels in the door (the center one is stationary) were made of tongue-and-groove stock glued together and nailed to the vertical cleats. Top and bottom panels are hinged to two-by-four cross rails at top and bottom of the center panel.—*Paul Corey, Sonoma, Calif.*

Now You Can Lay Blocks Like an Expert

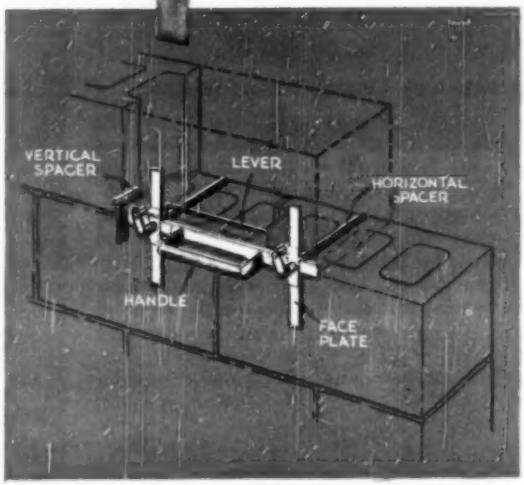


Laying concrete or cinder blocks is easier with the tool shown here. Spacers properly position the blocks. Moving lever to right flops horizontal spacers flat so tool can be withdrawn.

CONCRETE and cinder blocks can be laid quicker and easier with this machine that correctly spaces the blocks both vertically and horizontally. The Blockguide is priced at about $7 by the Automatic Machine Products Co., of Middletown, Conn.

Here's how it works:

Mortar is spread, the Blockguide placed as shown, and a block laid on the spacers. The face plates line up the front of the block with the blocks below. The spacers limit the amount of mortar between blocks. When the block is properly aligned, the lever is pushed, flipping the horizontal spacers on their sides so the machine can be easily withdrawn.



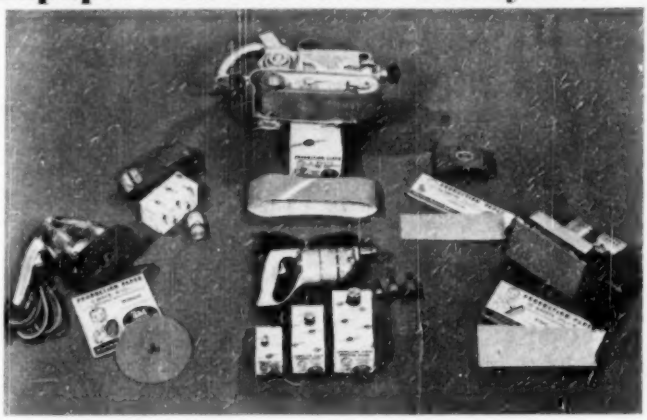
WIRE SIZES

Gauge No.	Steel	Copper and other metals
0000000	0.4900	
000000	0.4615	0.5800
00000	0.4305	0.5165
0000	0.3938	0.4600
000	0.3625	0.4096
00	0.3310	0.3648
0	0.3065	0.3249
1	0.2830	0.2893
2	0.2625	0.2576
3	0.2437	0.2294
4	0.2253	0.2043
5	0.2070	0.1819
6	0.1920	0.1620
7	0.1770	0.1443
8	0.1620	0.1285
9	0.1483	0.1144
10	0.1350	0.1019
11	0.1205	0.0907
12	0.1055	0.0808
13	0.0915	0.0720
14	0.0800	0.0641
15	0.0720	0.0571
16	0.0645	0.0508
17	0.0575	0.0453
18	0.0475	0.0403
19	0.0410	0.0359
20	0.0348	0.0320
21	0.0317	0.0285
22	0.0286	0.0253
23	0.0258	0.0226
24	0.0230	0.0201
25	0.0204	0.0179
26	0.0181	0.0159
27	0.0173	0.0142
28	0.0162	0.0126
29	0.0150	0.0113
30	0.0140	0.0100
31	0.0132	0.0090
32	0.0128	0.0080
33	0.0118	0.0071
34	0.0104	0.0063
35	0.0095	0.0056
36	0.0090	0.0050
37	0.0085	0.0045
38	0.0080	0.0040
39	0.0075	0.0035
40	0.0070	0.0031
41	0.0066	0.0028
42	0.0062	0.0025
43	0.0060	0.0022
44	0.0058	0.0020
45	0.0055	0.0018
46	0.0052	0.0016
47	0.0050	0.0014
48	0.0048	0.0012
49	0.0046	0.00099
50	0.0044	0.00085

Note: The "Steel Wire Gauge" is the same as Washburn and Moen, American Steel and Wire Co., and Roebling gauges. The gauge for copper is the same as the American Wire and Brown & Sharpe gauges. Dimensions given in the table above are in decimals of an inch.

FOR YOUR POPULAR SCIENCE INFORMATION FILE

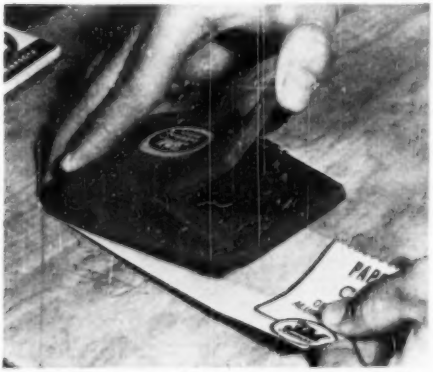
Industrial Sandpaper Now Precut for Handymen



ALUMINUM-OXIDE sandpaper, precut to fit workshop sanding tools like those at right, is now available to home workshoppers in handy packages. Long used by industry, aluminum-oxide grains outlast both flint and garnet. Grit designation has been simplified by the manufacturers, Minnesota Mining and Manufacturing Co., to four grades—fine, medium, coarse, and very coarse. These handle all common work from the removal of paint to final sanding in preparation for finishing.

Two sizes of disks—5" and 6"—have a center hole that fits arbors from ¼" to 1". Disks without holes are offered in 8", 10", and 12" sizes for use on disk sanders, faceplates, and circular saws. Sheets come in two sizes to fit oscillating sanders and a new rubber sanding block.

Sanding belts ranging in size from 2" by 21" to 4½" by 26" can be used on portable or stationary sanders. Small abrasive sleeves for use in electric drills, drill presses, or lathes are designed for sanding inside holes, curved cuts, mortises, and the like. Refill rolls of aluminum-oxide paper in three widths are offered for use in two popular types of magazine sanding blocks.



Packaged sheets 2¾" by 9" in size fit this molded-rubber sanding block. It has three prongs at each end to hold the paper firmly.

Waterproofing Matches

WATERPROOF matches for hunting and fishing trips may easily be prepared at home, according to the Shellac Information Bureau. Simply dip them in shellac and let them dry.

My Most Ingenious Solution

When I reached in my pocket for a brad or a tack, I used to come up with a handful of pocket fluff, matches, or toothpicks. Or else I stuck a tack in my finger. But not any more. What do you think I do now?

Now I bristle when I nail. I slip a magnet in my shirt pocket and stick the nails to the outside of my shirt. The magnet holds them there and I pick them off one at a time as I need one.—Warren Norcross, Philadelphia.

Cigarette dispenser (above) holds 10 packs. Canasta set (left) includes the tray in the center of the table and four card holders for the players.

New, Handy, and Quickly Made

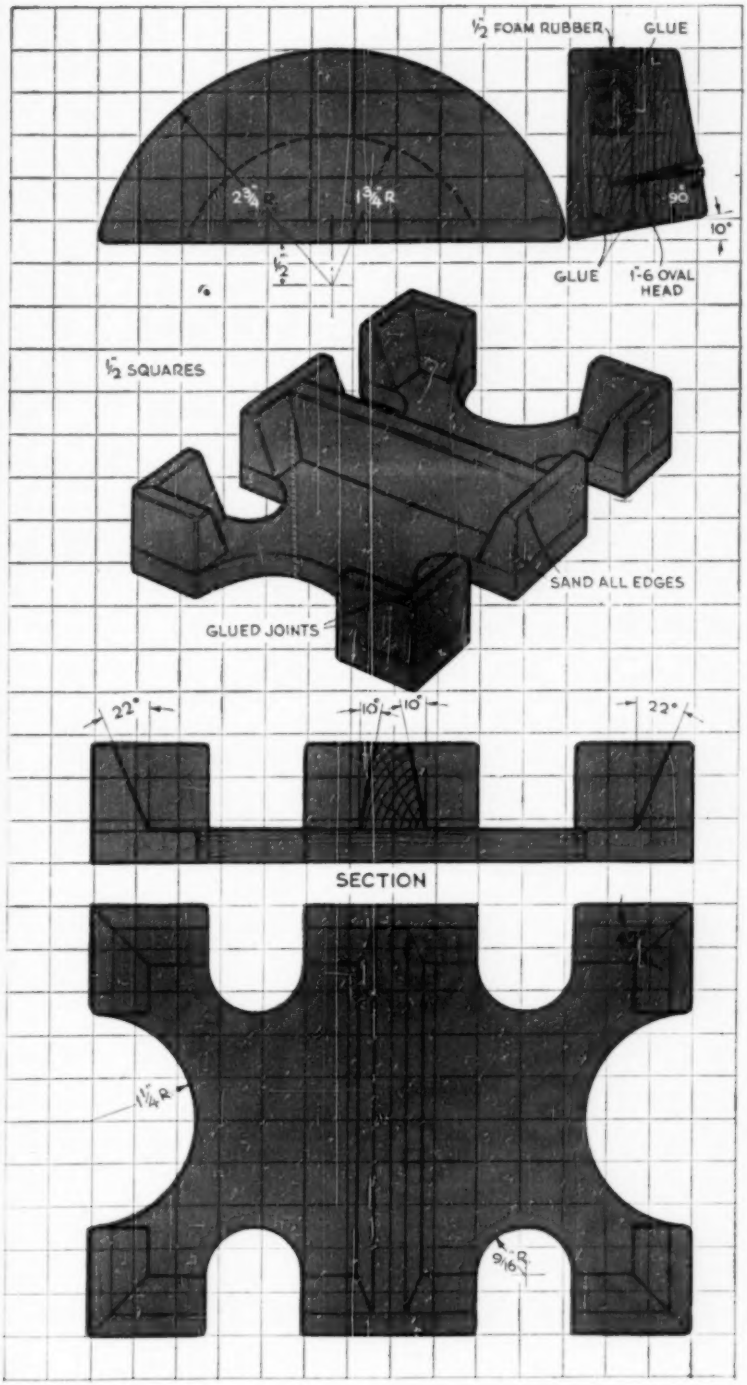
Christmas Gifts

Canasta players and smokers will like these products of a home workshop.

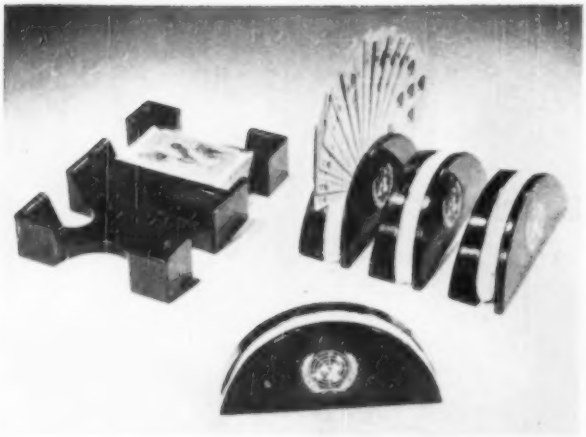
IF YOU'RE shopping for really unusual gifts for that special person, take a look at these—a canasta set and a cigarette dispenser.

The canasta tray holds two stacks of cards. It's designed with roomy cutouts so you can easily remove single cards or pick up the entire discard pile. And the sides of the tray slope, so cards form a neat stack as they're tossed in.

As any canasta player can testify, you often pick up an unwieldy fistful of cards. But slip them into one of these holders, and your hands are free to keep score, light cigarettes, or pass around refreshments. Should you have to get up to look at the baby or answer the phone, your cards will remain just as you left them,



United Nations symbol (above) can now be used to decorate any of your craftwork that is not used commercially.



Sloping sides of tray neatly stack cards as they are dropped in. Foam-rubber centers of the hand holders make it easy to insert or withdraw your cards.

held in place by the foam-rubber center.

The idea for the dispenser was borrowed from the kitchen matchbox holders that were so common before the automatic pilot light and electric range took over. You can drop a whole carton of cigarettes in the dispenser and withdraw one pack at a time from the bottom. The cutouts in the front let you see how many packs you have in reserve. On the dispenser pictured on the opening page the cutouts carry out the playing-card design.

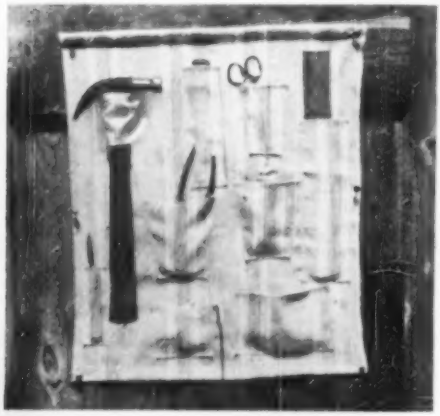
Card tray. Use a jigsaw or scroll saw to cut out the bottom from ¾″ stock. The drawing on the squares will give you the outlines for the cutouts. Dimensions and angles for the sides and center dividing piece also are shown on a drawing. This is strictly a glue job; no nails or screws were used.

Card holders. These are made of three pieces—back, front, and spacer. A ½″ piece of foam rubber is sandwiched between the front and back and on top of the spacer. The rubber is glued to the back of the holder but not to the front. As you can see in the photos, the cards are held between the rubber and the front of the holder. Once the first card is inserted, subsequent ones are slid in front, each overlapping the previous one.

Cigarette dispenser. This is made of ¾″ plywood. Here are the dimensions: front, 3½″ by 9″; back, 3½″ by 12″; sides, 2 5/16″ by 10″; and bottom, 2 5/16″ by 3″. All joints are butt joints held together by glue.

Before assembling the box, cut out the bottoms of the sides for finger clearance and cut out whatever designs you want in the front. The designs in the front can be left open or filled with clear plastic.

To keep the packs of cigarettes from falling out the bottom, a 3″ piece of ¾″ half round was glued along the bottom of the opening. You can make this piece by planing down a 3″ length of ¾″ dowel. Both the canasta set and the cigarette box were finished with black lacquer.



Pin-Up Rack Holds Tools

A HANDY pin-up rack for the essential household tools of everyday use may easily be constructed from a leftover strip of canvas. A strip approximately 15 inches square is ample and will fit neatly and colorfully on the back of a closet or kitchen door. Hem the edges and reinforce the ends with a strip of wood. Sew on pockets to hold such tools as scissors, ruler, hammer, screwdriver, pliers, tube of cement, assorted nails and screws, and a small ball of twine. Place a number of eyelets around the edges of the rack through which screws may be inserted to attach it to the door. The handsome racks make welcome holiday gifts for anyone.—*R. M. Woodbury, Ellsworth, Me.*

Do You Need Nonstop Wipers?

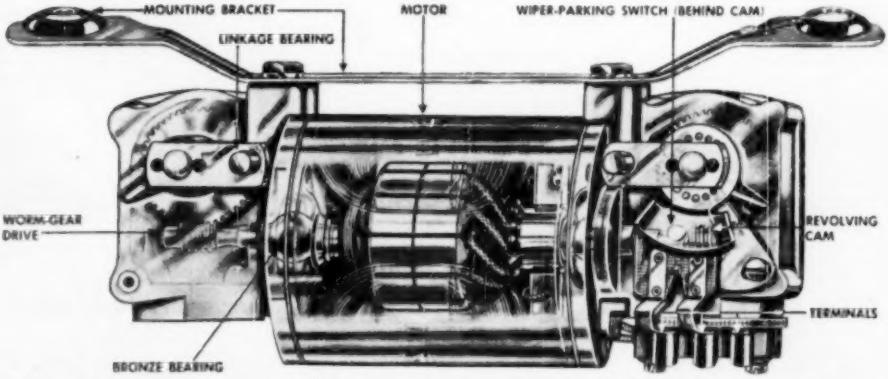
New kit enables you to install electric dual-action unit.

Ventilator is removed to tighten mounting bolts when you install dual electric wiper unit on a Plymouth.

POWERFUL, constant-speed wiper units that you can install yourself are now available in kit form. A dual electric unit drives both blades in unison at about 140 strokes a minute, regardless of engine speed or load. Automatic blade parking, a thermal overload cutout, and a two-speed switch are provided. Cost of passenger-car kits, with full instructions, is about $23.

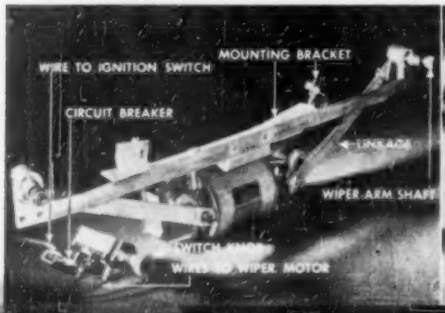
This unit is being put on the market this month by the American Bosch Corp., Springfield, Mass., for use on '48, '49, and '50 Fords, and '49 and '50 Mercurys, Chevrolets and Plymouths. Similar units for other cars may be produced later.

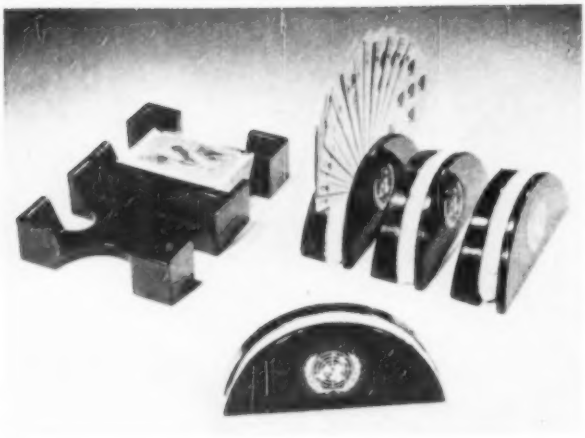
In switching to electric wipers, you can use the old wiper arms and blades if they are in satisfactory condition.



Phantom view above shows typical wiper unit. Wiper-parking switch, actuated by revolving cam, automatically brings wipers to rest at correct "park" position after current is shut off.

Linkages and motor for Ford come assembled as below. In others, linkages are separate. For Ford, you must drill two mounting holes, using cardboard template shown at right below.





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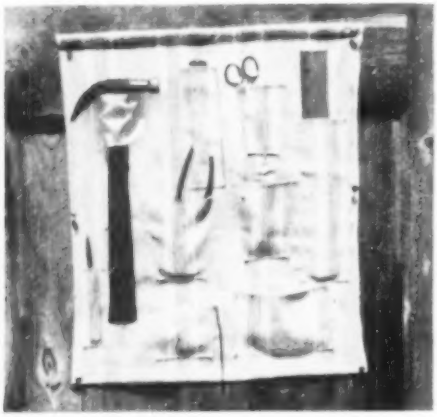

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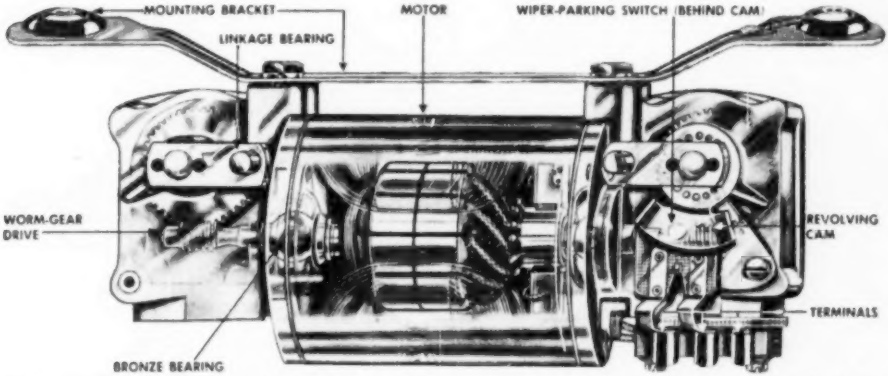
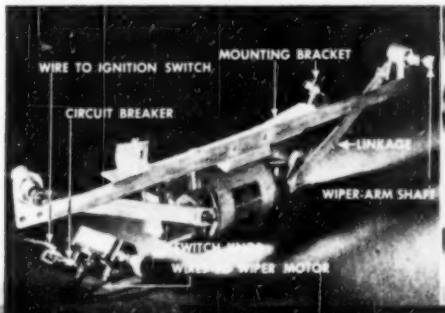
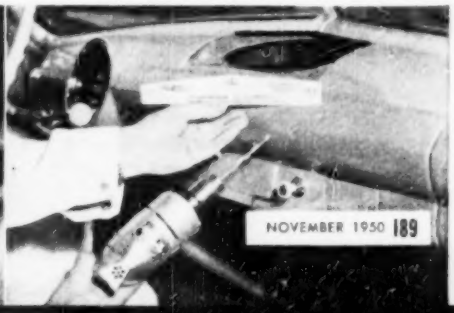


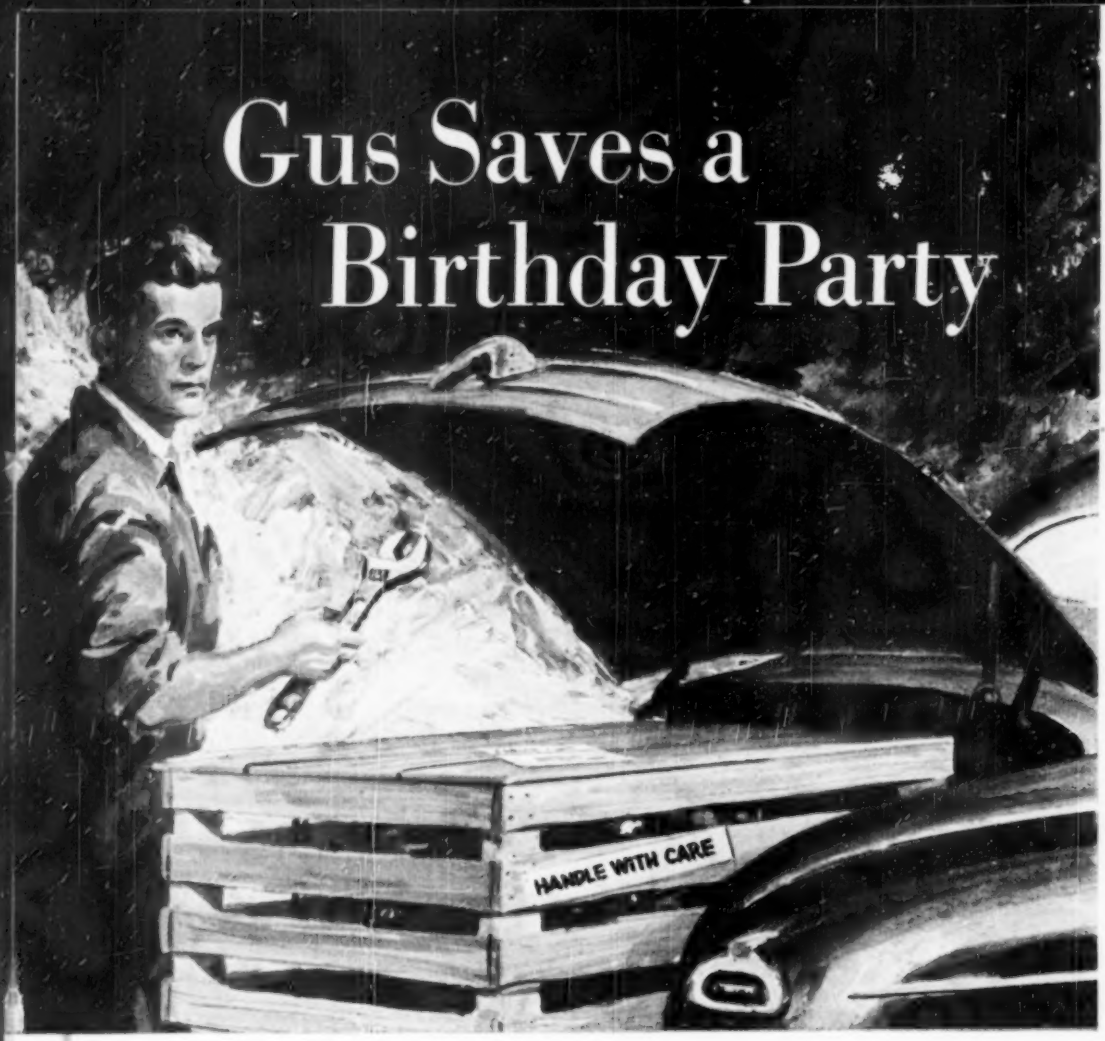
Phantom view above shows typical wiper unit. Wiper-parking switch, actuated by revolving cam, automatically brings wipers to rest at correct "park" position after current is shut off.

Linkages and motor for Ford come assembled as below. In others, linkages are separate. For Ford, you must drill two mounting holes, using cardboard template shown at right below.





Gus Saves a Birthday Party



When a pixilated gas gauge threatens to bust up a marriage, Gus and Stan hit on the hex and make everybody happy.

By Martin Bunn

IT WAS early on a recent Monday morning when a blue business coupe eased to a stop alongside the pumps in front of the Model Garage. If anyone had ever been curious enough to watch, they would have known that this same car pulled up at Gus Wilson's place at about the same time every Monday morning. Ted Dorman, the car's driver and an old resident of our town, was usually Gus' first cash customer every week.

"How many, Ted?" Gus asked after the usual greetings.

"Darned if I know," Ted answered. "My fuel gauge has gone sour. Reads empty no matter how much gas is in the tank. Just fill 'er up, Gus, and I'll have to watch my driving this week."

"Off on the usual trip?" Gus inquired as he unlimbered the gas hose.

"Yeah, off for another weary week on the road, peddling," Ted sighed. "You know, Gus, by the time Friday night rolls around

"What's the latest headache, boss?" asked Stan Hicks. "The kind that drives mechanics nuts," said Gus, eyeing Ted's crated birthday present. "I'm looking for pixies."

I'm so blamed tired of hauling my sample cases in and out of that trunk that I can't even face unpacking the car until Saturday. Wouldn't do it then," he added, "except Myrtle likes to use the car."

Gus had often wondered how Ted Dorman stood the week in, week out grind of traveling for a hardware jobbing concern down in the city. He has a big territory, which means driving at least 200 miles a day besides making at least a half-dozen calls between breakfast and supper. After close to 20 years of doing it, Ted is so fed up with driving that he seldom touches the car over week ends. If it needs an oil change or any repairs, Myrtle Dorman, Ted's wife, brings it in to the Model Garage on Saturdays.

"Better have your wife stop around with it when you get back," Gus suggested. "I'll check that gauge for you. Probably nothing more than a loose connection, but there's no sense touring around the country not knowing how much gas you've got."

Gus thought no more about the incident until the following Monday morning when Ted made his stop on the way out of town.

"Just fill 'er up again," Ted grumbled in answer to Gus' usual query.

"Thought Mrs. Dorman was going to bring the car in so I could fix that gauge for you," Gus chided.

"Bah," Ted grunted. "Deliver me from

females and cars. They'd drive them till they fell apart. I asked her to bring it over, but she swore up and down that the gauge was okay when she drove the car on Saturday. I've a hunch some hen canasta party in the neighborhood was more important to her than my car."

Ted obviously was burned up. "Here, take a look," he added when Gus had finished filling the tank.

Gus poked his head through the open window on Ted's side of the car. When Ted switched on the ignition, the needle on the gas gauge stayed right where it was—on the empty mark.

"Sure shows empty," Gus agreed. Then he opened the car door and reached in under the dash. "I thought it might be a loose connection," he explained after he had pulled his hand out, "but those at the back of the gauge seem tight. I'll have to go over the whole line when you've got the time."

Fuel Gauge vs. Canasta

"Well, one thing you can bank on," Ted growled, "Myrtle will be here with the car next Saturday. She's not going to talk me out of it this time—canasta or no canasta."

The following Saturday morning Gus was busy with a routine ignition job when he heard a female voice: "Gus Wilson, if you want to save a marriage you'd better do something about this gas gauge."

Gus looked up to see Myrtle Dorman standing in the doorway of the shop. Beyond her, just outside the shop door, was Ted Dorman's blue coupe.

"Ted's been raising the roof because I didn't bring the car around for you to check the gas gauge last Saturday," Mrs. Dorman explained, "but it worked for me last Saturday and it's working now. Take a look."

For the second time in five days, Gus poked his head into the Dorman's car and peered at the gas gauge. This time it showed better than half full.

"Well, I'll be . . . ," but the old mechanic didn't finish the sentence. Instead he wedged his big frame down between the seat and the pedals for a good look at the back of the dash. A moment later, he emerged, shaking his head.

"Can you leave the car here for awhile, Mrs. Dorman?" he asked. "About the only thing I can do is go over all the wiring as well as the gauge. That might take the best part of an hour."

Troubles of a Traveling Salesman's Wife

"Gracious, no," Mrs. Dorman replied. "I can't leave it here that long right now. I'm out to do my shopping for the week. That's the bother of having only one car and a husband who's a traveling salesman. Saturday is the only time I can stock up on foods and things. Besides, today I've got to stop by the railroad station."

"Well, can you spare 15 minutes?" Gus compromised.

Mrs. Dorman looked at her wrist watch.

"Fifteen minutes then, but no more," she agreed. "The express office down at the station closes at noon on Saturdays and I have to pick up a present we ordered for Ted's birthday tomorrow. He's been wanting a power saw for his workshop, so the boys and I pooled our pennies and got him one. Lord knows, though, with the fuss he's raising about this gas gauge I'm not so sure he deserves it. Hasn't been fit to live with since he got home last night."

Pixies Rear Their Heads

At the end of a quarter hour of concentrated trouble shooting, Gus was more puzzled than ever. There was no doubt that the gauge was working at the moment. Yet, he knew it hadn't been working the two times Ted had stopped by. The gauge seemed perfectly okay and what wire connections he could see were tight.

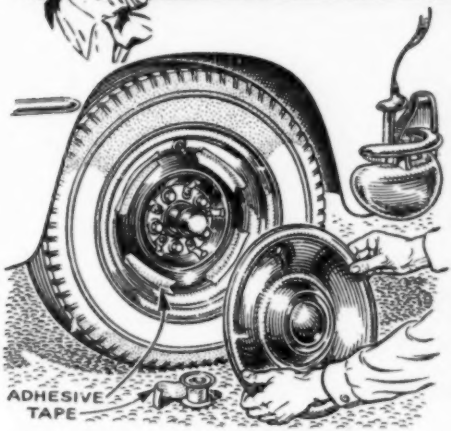
"No luck, Mrs. Dorman," Gus finally admitted. "Can you bring the car back sometime later this afternoon and let me have a real check?"

"I suppose so," Mrs. Dorman replied, "if it's absolutely necessary." Then she added sarcastically, "Maybe some of those pixies people talk about play tricks on Ted every time he drives the car."

As Gus got back to work he kept wondering about the fuel gauge. Mrs. Dorman had jokingly blamed pixies, and, at times, Gus

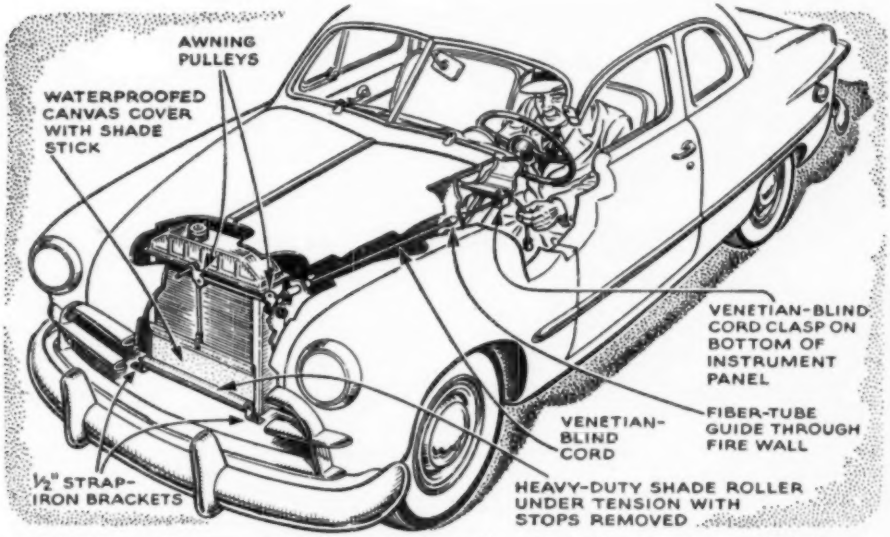
[Continued on page 242]

Hints from the Model Garage



Stones in Your Hub Caps? On gravel roads, small stones can fly through the slots in the backs of the wheels and rattle around in the hub caps. To keep them out, Alvin G. Gunter, of Rockford, Ill., suggests putting tape over the slots.

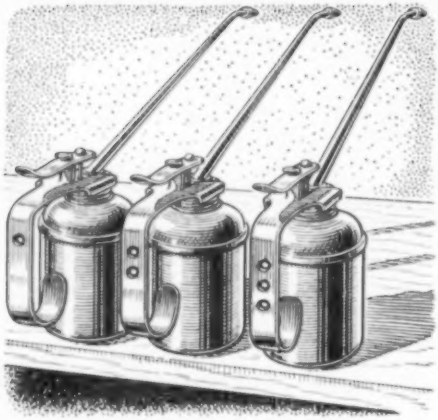
Drain Holes Save Muffler. If your new muffler doesn't have drain holes, drill a couple of small ones in the places shown in the sketch. These will allow water and condensation to drain out, reducing the likelihood of the muffler rusting.



Radiator Cover Warms Engine. When the thermometer dips toward zero, an adjustable radiator cover will give your engine a nice boost. Donald Richards, of Brooklyn, N. Y., installed this one after finding he got little benefit from his hot-water heater on cold days. The cover can be adjusted while driving.

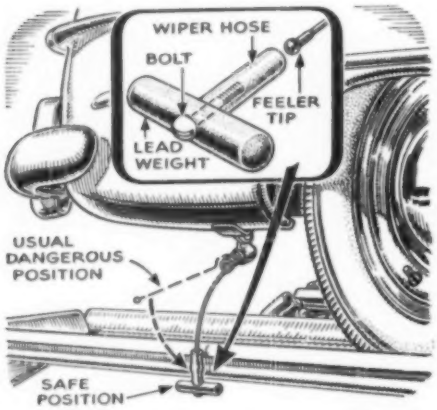
Turn the page, please, for four more auto hints.

MORE Hints from the Model Garage

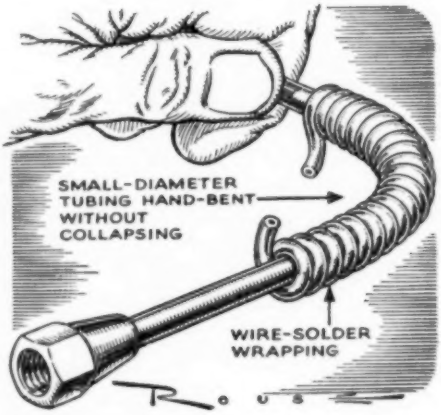


Holes Identify Grade of Oil. In some shops it's common practice to keep several similar pump oilers filled with oil of different grades for different jobs. To avoid mixups, Marion L. Rhodes, of Knightstown, Ind., suggests drilling identifying holes in the handles—one for No. 10, two for No. 20, and three for No. 30.

Rubber Holds Truck Cover. To save time in lashing a tarpaulin over a stake body, cut rubber bands from an inner tube and tie one to the end of each rope. Then you can slip the rubber band on or off the hook instead of tediously tying or untying the rope. The elastic keeps the ropes and cover tight.



Watch Out for Curb Feelers. When a car is on a hoist for a lube job, the new curb feelers are at just the right level to jab an unwary worker in the eye or face. To eliminate this hazard, Marion L. Rhodes, of Knightstown, Ind., keeps on hand a couple of weights made as shown in the sketch above.



How to Bend Tubing. In replacing an oil or gas line, you usually have to make several short-radius bends in the tubing. To keep the tubing from collapsing, Frank M. Butrick, of Alma, Mich., suggests first wrapping it at the bend point with a piece of wire solder. Remove the solder after making the bend.

A good week-end job is in progress here. A cover is being fastened to the rear-seat back rest after sewing is complete. Call on your wife to do sewing part if this stumps you.

Woman's work? Well, perhaps, but . . .

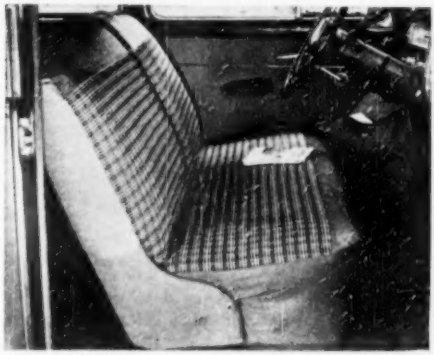
Making Your Own Seat Covers Saves Money

By Walter E. Burton

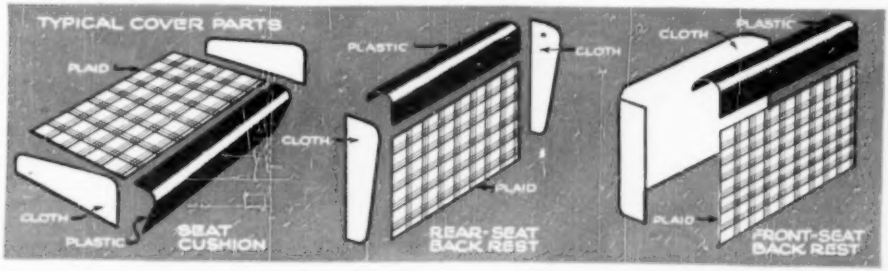
BY DOING your own cutting and fitting, you can have a set of de luxe seat covers that normally would cost $40 or $50—and you'll spend less than $10.

Mine cost exactly $6.53. Here's what I bought:

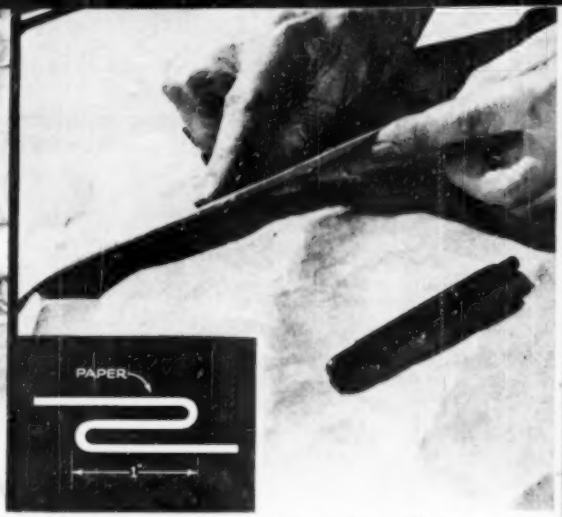
- Three yards of a strong, open-weave, plaid-pattern cotton cloth called Copan. This comes in a 57-inch width and cost me 89 cents a yard.
- Two yards of supported (cloth-backed) vinyl-plastic sheet, resembling leather, priced



Plastic and a cotton plaid are a good combination for seat covers. A cloth-backed vinyl sheet was used across front edge of seat and on top of back rest in the covers shown here.

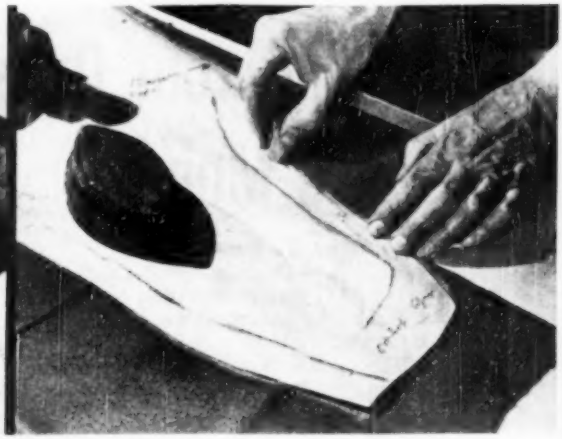


1 Paper patterns are the first step. Pin wrapping paper to the back rest or seat and outline the pattern with a pencil. Here, position of plastic strip across top is being indicated.



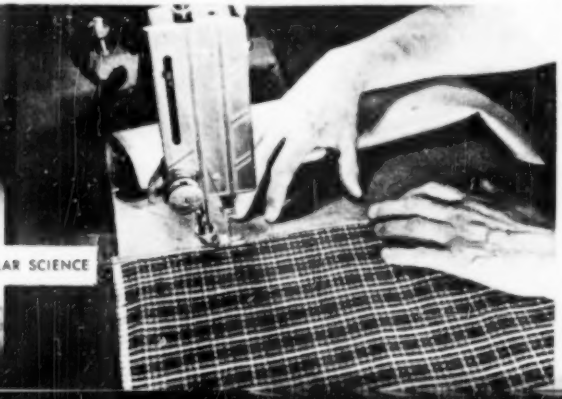
2 Allow for seams in cutting patterns. This can be done by making double fold near the center line of paper in both directions. Cut pattern with folds in place. Then smooth out.

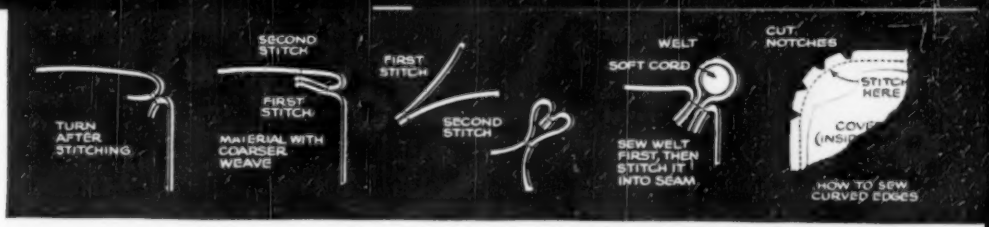
3 Welt on cushion can often be traced to mark pattern edge. Take seats from car if possible. After outlining or cutting each pattern, mark what it represents in the finished job.



4 Chalk pattern on your fabric. For a small pattern like this endpiece, you can make seam allowance when cutting the paper. Weight or pin the pattern while marking the fabric.

5 Use a double-fold seam to join the plastic and plaid parts. This seam interlocks and the pieces pull against each other like two hooked fingers. Face the plastic and plaid together, fold plaid over, and sew once. Then fold back the plastic and run two more seams.





at $1.28 a yard in the 54-inch width.

- Three yards of a fairly heavy cotton cloth, costing $1.20 at a department-store remnant counter. This was used for the ends, backing, and edge binding.
- Two spools of heavy-duty cotton thread, at five cents each.

This material produced seat covers that, in my opinion, compare very favorably with high-priced custom jobs. Still less expensive than mine, and a bit easier to sew, would be all-cloth covers made from denim, gabardine, or sail cloth.

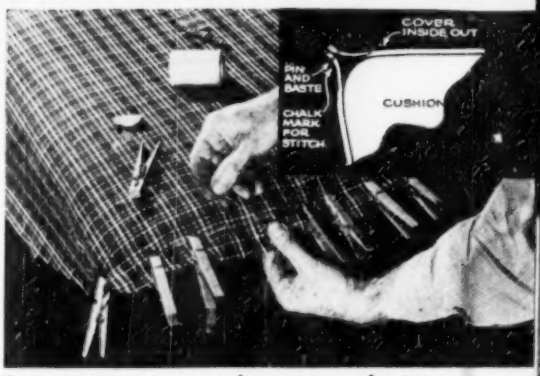
Where to get material. You may find what you want at a department store, an auto-supply dealer, one of the surplus stores, or perhaps the local outlet of a mail-order house. The plaid and plastic materials I used came from Charles Burgoon & Co., of Akron, Ohio.

You will probably need about the same amount that I did. My job was done on a club coupe—divided front seats and a small back seat. Even for a large sedan, an extra yard of each of the two major materials should see you through.

Plastic resists soiling and wear better than cloth. But a seat cover made entirely of a material like vinyl upholstery sheet may be uncomfortable in hot weather.

Cutting patterns. An easy way to provide for seam allowance when cutting a paper pattern is to make a double fold 1" wide in the paper near the center line of the cushion in both directions—or sometimes parallel to the width only.

When plastic sheeting is used, it usually is run across the front of each seat cushion, extending back about 3" from the front edge to meet the main cover fabric; and across the top edge of each back section and down the front for a distance of 3" to 5". It also can be used across the back surface of the front seat.

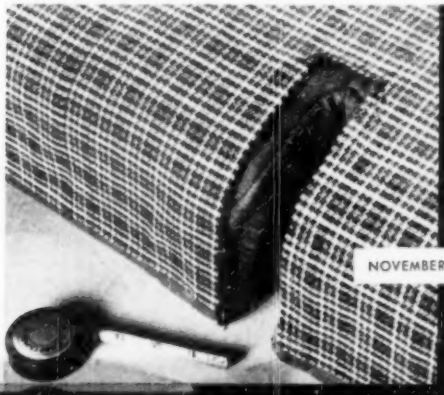


6 Fit cover parts to cushion wrong-side out and pin and baste the edges together. Then chalk for the final stitching. Sew with cover still wrong-side out, using any of the stitches shown in panel above. Turn your finished covers and slip them over the seat or back rest.

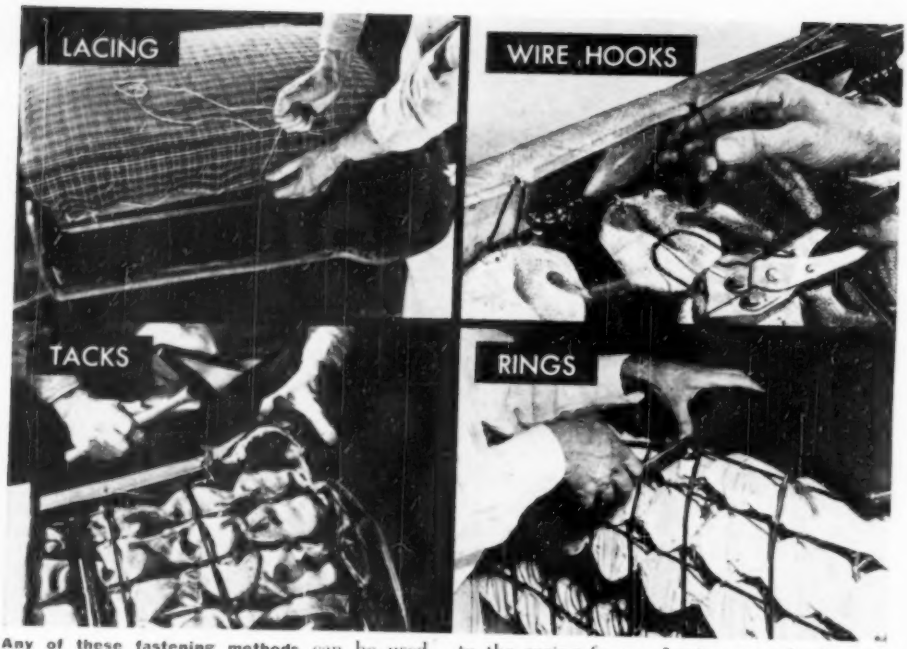
Joining plastic and cloth. Wherever plastic joins the plaid or other seat-cover material, a double-fold seam should be used, with the plastic on top. Because of the interlocking of both materials, this seam will withstand severe stress.

A difficulty with sheet plastic is that considerable care is necessary to make it fit snugly around seat corners and edges. Often you have to make cuts and seams to shape

7 Front seat cover often must be notched. Hem the notch edges. A strip of cloth sewed to back edge of cover is fastened under cushion.



8 You can use cotton as padding if the covers don't fit smoothly. The corners and top of front seats are most likely to need padding.



Any of these fastening methods can be used to keep the covers tight. You might also want to try tie strips—strong tape about ¾" wide sewn at intervals along edge of cover and then tied to the spring frame. Lacing, wire hooks, and tie strips make it possible to remove the covers easily for cleaning. Crimped rings are the most common commercial fastening method.

it. The objective should be to avoid wrinkles, bumps, and low spots.

Fitting and sewing. Because most automobile seats and backs are reasonably symmetrical, it usually is feasible to fit the cover wrong-side out and then reverse it. Place all pieces in their proper position, allowing 1" all around for seams, and secure them temporarily. With chalk or soft pencil, mark all stitching lines. Usually you can follow the seam in the original upholstery. Baste the parts to hold them while you machine-sew them. For plastic sheeting, use a coarse stitch and moderate thread tension.

A simple stitched seam is strong enough in most cases, but a second stitching will assure you greater strength. For improved appearance, a decorative welt can be incorporated in the seams. Reinforce corners and other points of high stress by extra stitching.

After the cover is in place right-side out, you may have to do a little hand-sewing, particularly at the corners. Where seams are curved, cut V-shaped notches to prevent excessive wrinkling.

Fastening the covers. There are several ways you can do this. They include:

1. TACKING. Use medium-sized carpet tacks. Drive them into the strip provided on the underside of some cushions.

2. LACING. Metal eyelets can be installed in the plastic hem and strong cord run through them and laced around the spring frame. Or an upholsterer's needle, threaded with chalk line or other heavy cord, can be used to lace or sew edges to the frame.

3. WIRE HOOKS. From coat hangers you can make hooks that are crimped through seat-cover hems or eyelets and around elements of the seat frame.

4. SHORT C-SHAPED HOOKS. These are like hog rings and can be put in with pliers.

5. TAPE TIE STRIPS. Strong tape ¾" or so wide can be sewed along the edges and laced to the spring frame.

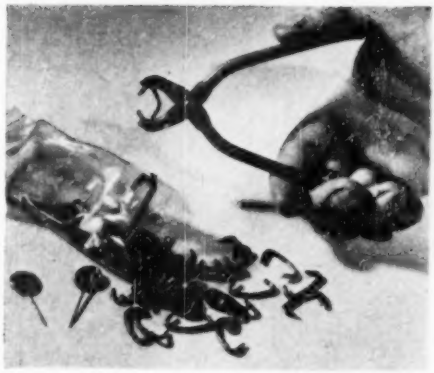
Whatever the fastening method, pull the covers as tight as you can without damaging them or compressing the cushion too much. They will stretch some when used. So, after you have used the covers for a week or two, refasten them to take up any slack. END

Ready-Made Covers Must Be Pulled On

READY-MADE seat covers sometimes fail to give satisfaction because they have been put on too hastily and carelessly.

They are not tailored to your car like a custom set. Instead, they are turned out on an assembly-line basis to suit various cars, yours among them. So making them fit sometimes requires a lot of pulling and stretching.

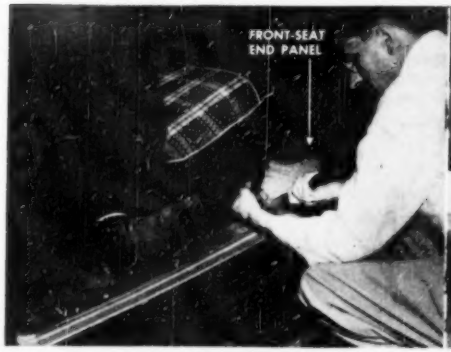
You might use any of the fastening methods suggested on the preceding page—but crimped rings normally will hold them tightest. Don't hurry the job. It may take two hours or more to do it thoroughly.



Ring fasteners are best because you can pull and hold covers tight. An inexpensive tool crimps them together. The pins shown are useful for a few spots where rings can't be used.

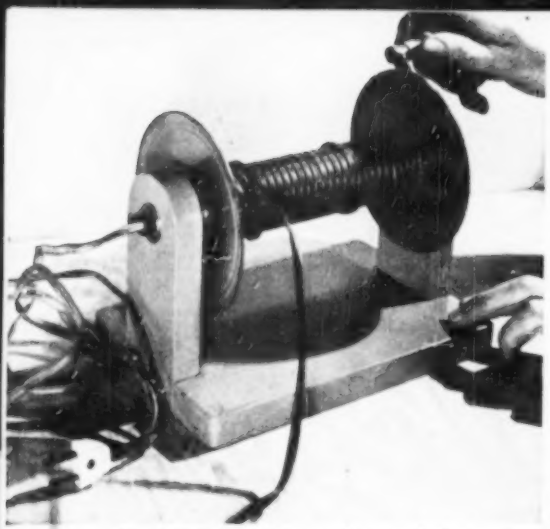
Remove rear-seat back rest. In this case it was done by taking fiber facing from trunk, bending down tabs, and removing the screws shown. Other seats fasten in passenger compartment.

Use plenty of rings. Procedure is to pull the cloth tight and crimp ring through cloth and around spring frame. Single package of rings usually comes with set of covers. Buy more.

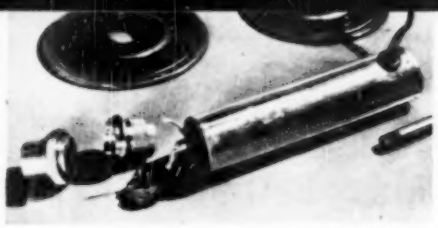


Tacks are needed, too, under most front seats. It's impracticable to remove many front seats, so job must be done in car. End panel that lapped side of seat was removed here.

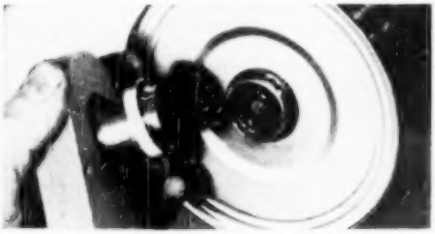
Rope rails may hook or screw into place. This one comes out when twisted. Remove rails and fittings before slipping cover over the back of front seat. Cut cover to reinstall fitting.



Long length of wire winds on reel. Current can be fed continuously while the reel is turned.



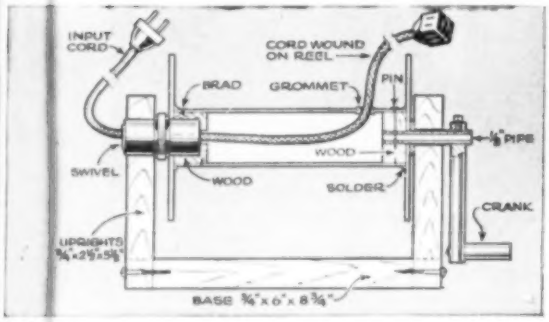
Cord runs through spool core to the rotating swivel. The disks were cut from coffee cans.



Rotating connector is heart of the reel. Wood plug in spool supports inner end of connector.

Extension-Cord Reel Uses New Swivel Connector

It's now an easy job to build an extension-cord reel that will turn out just the right amount of wire to reach a tool or light a hundred feet or more from your electric outlet. For the rotating electrical connection, you can use a swivel made by Robboy Electric Mfg. Co., of Cleveland. It sells for about a dollar.



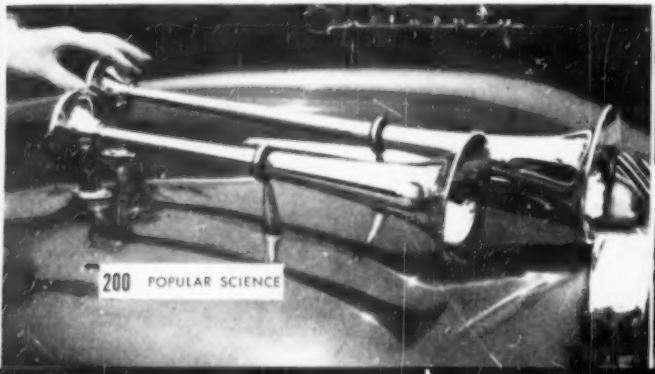
For the reel disks, cut the bottoms from a couple of coffee cans. Roll up and solder a sheet of tin-can material for the core. Force hardwood plugs into each end. Pin the crankshaft in a 5/16" hole drilled axially through one plug and mount half of the electrical swivel in the other.

Pass the extension cord through a grommet placed in the tube and connect it to the lugs on the inner half of the swivel. Attach your input cord to the other part. A wood frame will support it nicely.

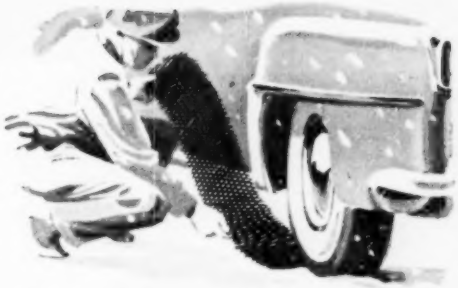
Vacuum-Operated Compressor Blows Air Horns

You can now equip your car with a set of air horns. A compressor operated by intake-manifold vacuum supplies the air.

Made by the Hadley Manufacturing Co., of Defiance, Ohio, the outfit includes horns, compressor, storage tank, valve, and steering-column control. One filling of the tank gives 10 to 20 blasts on the brass horns. When pressure falls, the compressor automatically builds it up.



Winter Driving Tips



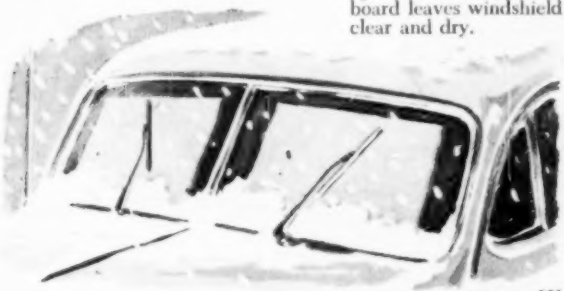
Two pieces of metal lath rolled up and stored in the trunk are good insurance against staying stuck in the snow or mud. Wedged in front of the rear wheels, they'll give good traction.

An old blanket hung on a wire stretched across the rear of your garage will help warm up your engine in the morning. With the radiator snug against it, the fan will be less effective.

Calking the air duct shut may be the solution for cold feet on the driver's side of cars fitted with twin ducts. Left duct usually isn't needed during the winter. Disconnect valve and apply calking around it.

Locks freeze? Rubber tips for chair legs will slip over push-button locks, keeping out the rain and snow. Such protective tips can be found in most hardware stores.

Under-seat heaters can usually be made more efficient by removing the seat and cleaning out the lint, dust, and other material in the core. Use an air hose to blow out the dirt.



Slip pieces of corrugated cardboard under the wipers if you expect an ice or sleet storm while you are parked in the open. Removed, cardboard leaves windshield clear and dry.

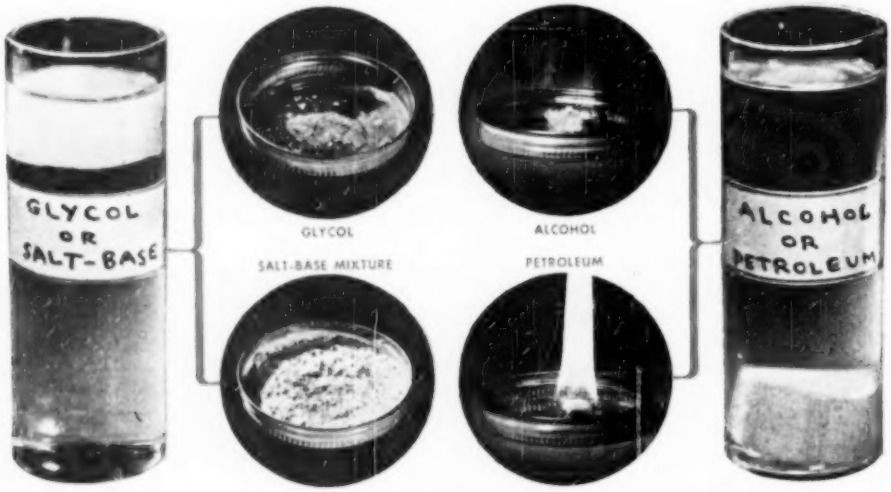
Is Your Antifreeze

HOW TO IDENTIFY ANTIFREEZES

In the glasses above are four types of antifreeze you might be offered this winter. Two are safe—two should never be used. How you can tell them apart, even if misleadingly labelled, is shown in these tests.

Your first clue is the relative weight. Drop a slice from a paraffin candle into a vial containing a sample of your undiluted antifreeze and see what happens. If the candle slice floats, the antifreeze is either the glycol or the salt-base type. If it sinks, the antifreeze has either an alcohol or petroleum base.

Then, to distinguish the glycol from the salt type, or the alcohol from the petroleum type, proceed as shown below. Glycol and alcohol are the safe types.



Is it glycol or salt? To find out, pour some into a jar lid and heat it until the liquid has boiled away. Glycol will leave little or no residue. A salt-base antifreeze will leave a heap of white to brownish crystals.

Is it alcohol or petroleum? For this, pour a few drops on a piece of cotton in a jar lid and put a match to the cotton. If it's alcohol, the flame will be clear blue. If it's petroleum, flame will be yellow and smoky.

Damaging Your Car?

Tests that any schoolboy can make will protect you from dangerous solutions.

By Kenneth M. Swezey

A GOOD antifreeze in a well-maintained cooling system is as consoling as a fur coat. But a saboteur—or even a reliable preparation in a system that has been poorly serviced—can cause irreparable engine damage, fire, or even death by vapor poisoning.

Most of the treacherous antifreezes have a salt base, perhaps magnesium or calcium chloride. These salts *do* lower the freezing point of your engine's coolant, as any antifreeze should, but these preparations also attack your engine the instant you pour them in.

Fortunately, even if the maker's label doesn't tell you, you can easily detect the dangerous types. The simple sink-or-float and boiling-and-burning tests illustrated on the opposite page will show you which type you have in your car.

The National Bureau of Standards recommends both:

- A "temporary" type. This is alcohol—denatured ethyl alcohol (ethanol) or synthetic methyl alcohol (methanol).
- And a "permanent" type. This usually consists chiefly of ethylene glycol.

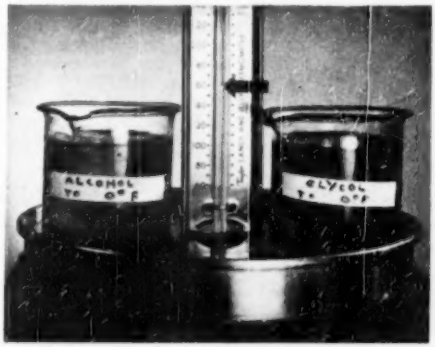
Both types normally contain a rust inhibitor.

What the others do. Government agencies and car makers have long warned against the use of salt-base and petroleum-base antifreezes. But both types are still available and may be offered to you if approved types become scarce.

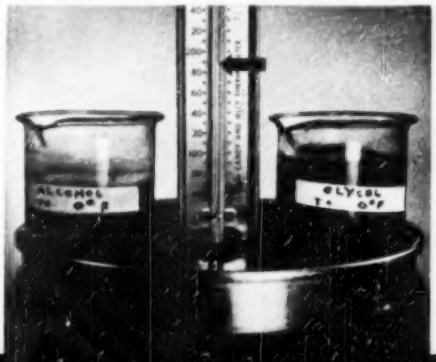
A salt-base antifreeze hastens rusting. Corrosion soon blocks radiator tubes, starts leaks, and causes overheating of the engine. In a matter of weeks, it can destroy a water pump and eat through a cylinder head. After a leak occurs, the solution may spray on the ignition wiring and, being a good conductor, cause numerous shortcircuits.

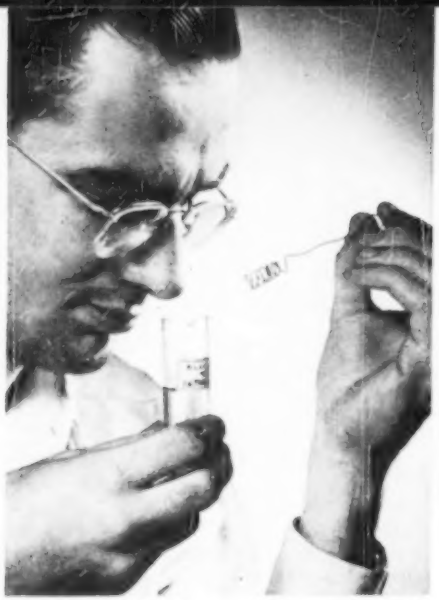
Petroleum-base antifreezes attack the rubber radiator hose, which finally leaks, spills out liquid, and perhaps sets fire to the engine. Theoretically, if the engine overheats until a petroleum-base antifreeze reaches its boiling point (400°-500°F.), the bearings would burn out or the pistons would seize in the cylinders, and solder would drip from the radiator.

Alcohol is cheaper. Alcohol is more popular than glycol, the other approved type of antifreeze, because it costs less. For ordinary passenger-car service, one filling should last a whole season, even though alcohol mixtures boil at a temperature below that of water. Boiling over through the overflow pipe results in a loss of alcohol. But this should not happen if the thermostat is adjusted to open at 160°F., the cooling system is kept free from rust, and the



Alcohol antifreeze can often give as prolonged service as glycol if cooling-system thermostat is set to operate at 160°. As seen above, an alcohol solution raised to this temperature maintains its volume beside a glycol solution that gives same freezing protection. If temperature of bath is raised to 190°, however, the alcohol boils away, as shown below.





Your nose will tell you whether your alcohol antifreeze is of the ethyl or methyl variety. Heat small coil of copper wire to redness in gas flame and plunge the coil into a little of the sample in test tube. Then remove the coil and smell the vapor from the tube. If it reeks with the pungent odor of formaldehyde, the liquid is methyl alcohol; if the odor is milder and not unpleasant, it's ethyl alcohol.

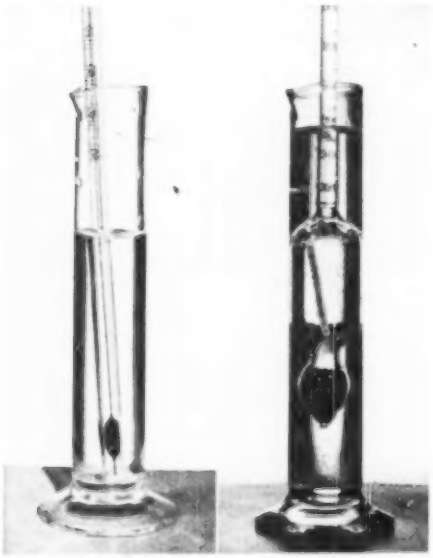
radiator is not over-filled. Boiling can be minimized by limiting the alcohol to the amount needed for the required protection.

Ethylene glycol antifreeze has a higher boiling point than water. That's why it's considered permanent. Violent boiling, however, can cause glycol antifreeze to be lost through the overflow pipe.

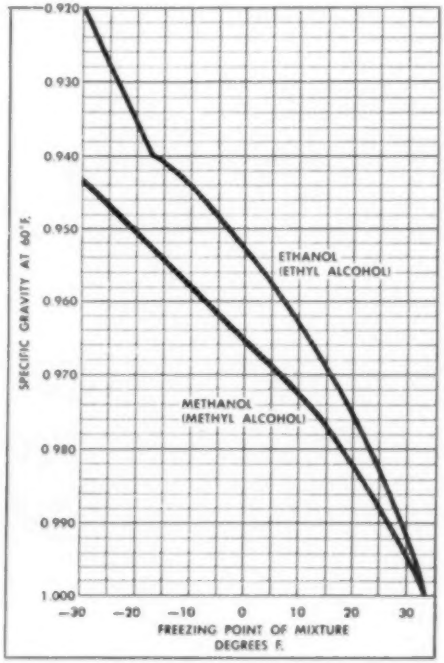
Use them only one season. Experts say antifreeze should be completely renewed each winter because during use corrosive salts are often formed in the solution. Addition of new rust inhibitor doesn't help. Antifreeze is often used for more than one season, but it's risky.

Prepare your cooling system. A good antifreeze may cause almost as much trouble as a dangerous antifreeze if your cooling system is not properly prepared to receive it. Leaking alcohol vapors may dangerously poison a car's occupants. Leaking glycol forms a sludge with lubricating oil that can damage a car.

Have the cylinder-head gasket checked and the bolts tightened. Replace the hose, if necessary, and tighten the hose clamps. If you use glycol, retighten these clamps after several days to compensate for shrinkage. Be sure the cap gasket is good.



Degree of protection given by ethyl or methyl alcohols can be determined with help of thermometer and hydrometer. Measure specific gravity with solution at 60° F. Freezing point can then be found by consulting graph (right).

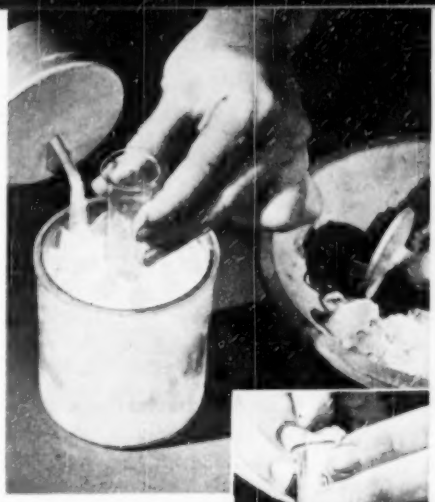


Test your solution regularly. The mixture also should be periodically tested with a hydrometer. Unfortunately, cheap hydrometers for this purpose are hard to read and often far from accurate. Good ones cost from $4 to $5 or more. Besides, different brands of glycol (because of different corrosion inhibitors they contain) have different densities, which require separate scales if not different hydrometers to give an accurate reading.

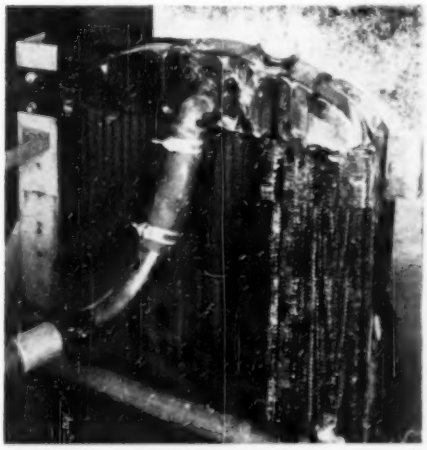
For about two dollars, however, you can buy an accurate hydrometer and jar from a chemical supply house. Along with the graph on the facing page, you can then check the protection of ethyl and methyl alcohol solutions down to minus 30°F. Get one with a *specific gravity* scale that reads from 0.900 to 1.000.

As the density of antifreeze changes with its temperature, you must first get the temperature of your specimen to 60°F. Then drop in the hydrometer float and tap the jar until it comes to rest.

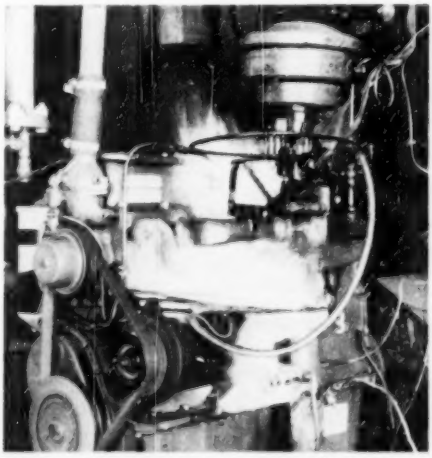
Testing a mixture. If you have mixed glycol and alcohol antifreeze in your radiator, a hydrometer test is useless. Only an actual freezing test will guarantee you protection. For temperatures above zero F., this can be made as shown at the right. For lower temperatures, a mixture of dry-ice chips in alcohol can be used as the freezing medium. END



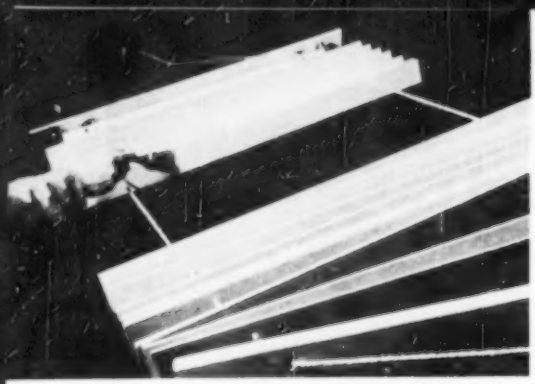
Freezing test requires only a narrow household thermometer, sample of antifreeze mix in test tube, and (for temperatures down to zero F.) a mixture of 70% cracked ice and 30% salt in a suitable jar. Freeze the sample by placing it in the jar as shown. Then remove the tube and stir the contents with the thermometer until the last ice crystal melts. Thermometer will then show temperature to which the present antifreeze solution will protect your car.



A salt-base antifreeze might leave your radiator in this corroded condition. Photo shows test unit in Bureau of Standards laboratory. Test stopped when the drain cock rusted off, emptying the liquid from the cooling system.



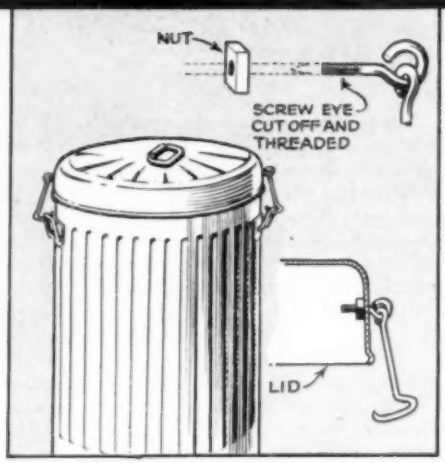
Heat could start an engine fire if you used a petroleum antifreeze. Here's what happened when a little was spilled on the exhaust manifold of a Bureau of Standards test unit. If hose split, your engine could also catch fire.



Easy Way to Paint Blinds

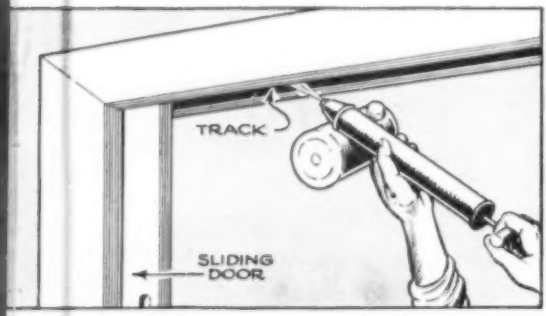
You can simplify the tedious chore of painting Venetian blinds if you rig up a rope hammock as shown above. String the heavy top and bottom slats at each end of the rig. Be sure the rope is sound and all knots firm before you start painting.

As one side of each slat is painted, it is pushed along to within a few inches of its neighbor. When the slats are completely dry on one side, the procedure is reversed.—*Will Thomas, Buffalo, N. Y.*



Door Hooks Lock Garbage Can

A couple of large door hooks altered slightly will keep your garbage-can cover from being blown off by the wind or knocked off by prowling dogs and cats. Hooks are bolted to the cover of the can as shown in the drawing. These engage the can's handles, lifting them and locking on the cover.—*V. H. Lamoy, Upper Jay, N. Y.*



How to Oil Sliding Doors

Squeaky sliding doors defy most home repairmen's efforts to lubricate them. There is seldom any provision made for getting oil up to the wheels on the overhead track.

A small insecticide sprayer filled with light machine oil will do the trick. Spray vigorously into the track slot in the casing along its full length. Slide the door back and forth several times before the vapor settles, then wipe the surplus oil from the casing.—*W. H. McClay, Pasadena, Calif.*

Socket Plate Frames Photos

Are you long on photos and short on frames? Try using an electric-socket plate. Attach the pictures with cellulose tape. A three-sided cardboard easel screwed to the back of the plate makes a sturdy stand, or a small angle bracket can be used instead.

Paint Improves TV View

If your TV set has a metal border around the face of the screen, you may improve your viewing by painting the metal border a flat black. The black will prevent the reflection of light from the metal that sometimes weakens the TV picture.

Professional Designs for Amateur Santas

Sort out the things in your scrap box and you'll probably find everything it takes to produce these guaranteed-to-be-popular Christmas toys.

PETTIGREW AND POOKY

COWBOY stuff, construction machinery, and circus playthings head this year's hit parade of Christmas toys. Manufacturers who follow the trends in juvenile taste have been producing scads of them to display in stores at fancy prices.

But any POPULAR SCIENCE craftsman can turn odds and ends from his shop into toys like these, designed by experts, that will appeal as strongly to the small fry as any that money can buy.

"Put-'Em-Up" Pettigrew and his pinto Pooky will delight both boys and girls—and parents, too. Pettigrew is a bow-legged, two-gun gent who can flourish his miniature pistols a-foot or a-horse. And Pooky, a direct descendant of Don Quixote's horse Rosinante, flexes his neck and legs, the better to express himself.

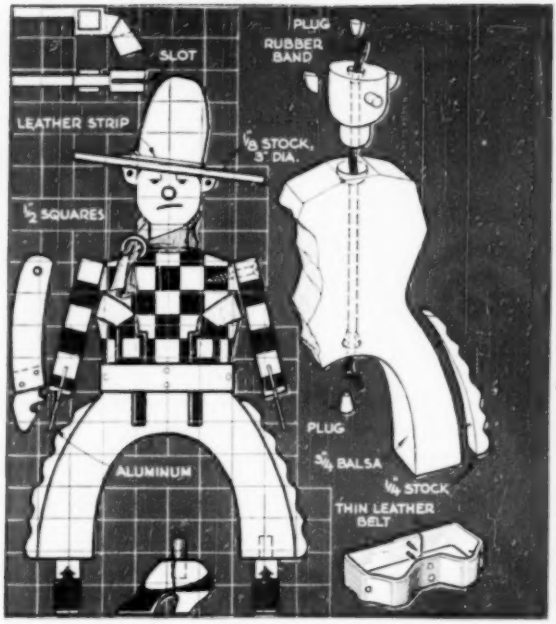
Chugger the Tugger has six wheels for floating over the many obstacles on the living-room floor with the utmost ease—regardless of what's tied on behind. And this toy will perform as well after a session in a sandbox as when it comes from the shop.

Sammy the Seal spins a ball on his nose and bobs up and down on his gaily painted platform whenever he crosses the room—but never asks for a fish.

Four pages of instructions follow.

SAMMY THE SEAL

CHUGGER THE TUGGER



Cowpuncher and his horse are simple drill and scroll-saw jobs.

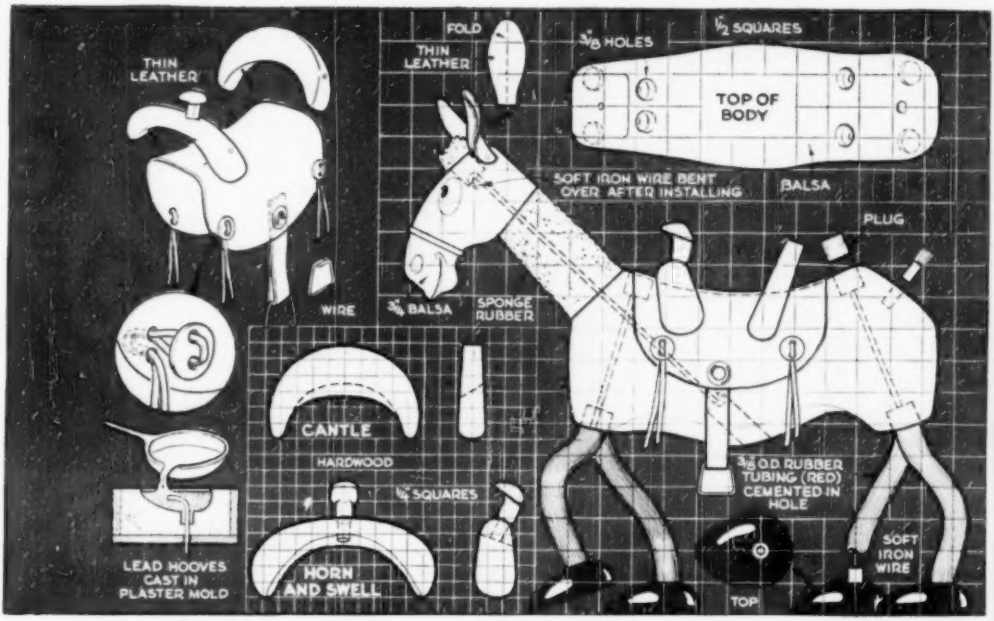
To MAKE the cowpuncher and his horse, use the squares on the drawings to lay out the figures on white pine or balsa. Then use a scroll saw or jigsaw to cut out the pieces.

Pettigrew. Boots, head, and arms are sawed out separately from the body. His hands are cut from thin sheet aluminum. Slots in the handles of the revolver should fit snugly over the hands so Pettigrew can hold his guns.

Note that his legs are bowed to fit closely over the horse's back. His head can be turned in a ball-and-socket joint—a rubber band providing the tension. The dotted lines down the body show you where to drill. The rubber band is secured at the bottom of the body and at the neck.

The hat and head unit is made in two pieces and glued together. Holster and belt are cut from a thin piece of leather. If you want to go to the extra trouble, Pettigrew will be more stable if you cast his boots from lead.

Pooky. Follow the dotted lines with your drill to make holes for the iron wire and plugs that anchor the legs. Make a plaster of Paris mold for casting the hooves and embed a piece of soft iron wire in it, as shown in the sectional drawing. The wire should be of the same quality as baling wire



but slightly heavier so it will take a lot of bending without breaking.

Apply cement to the nub on top of each hoof and slip a piece of rubber tubing down over the wire. Then apply cement in the socket for the upper end of the leg. Push the wire up through the body, bend over the end, and cover it with a plug or composition wood.

Before you put the wire through the sponge-rubber neck, sharpen the end. Work it through the rubber by twisting it as you push it. Apply rubber cement where the neck joins with the body and head.

The tail can be made of any kind of hair you have handy. Glue the hair to a tapered peg and drive the peg into a hole in the body. The ears are cut from thin leather. Brad the accessories to the body of the horse.

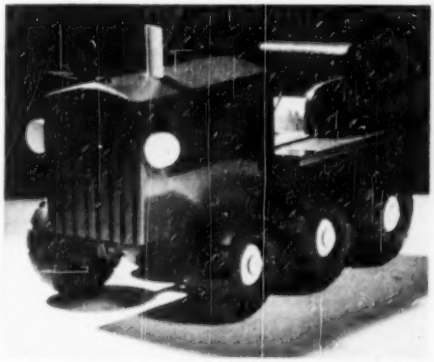
Hi Sibley, a veteran contributor to these pages, designed this cowboy and his horse, and Roland Cueva built 'em.

Tractor parts from scrap are doweled and glued together.

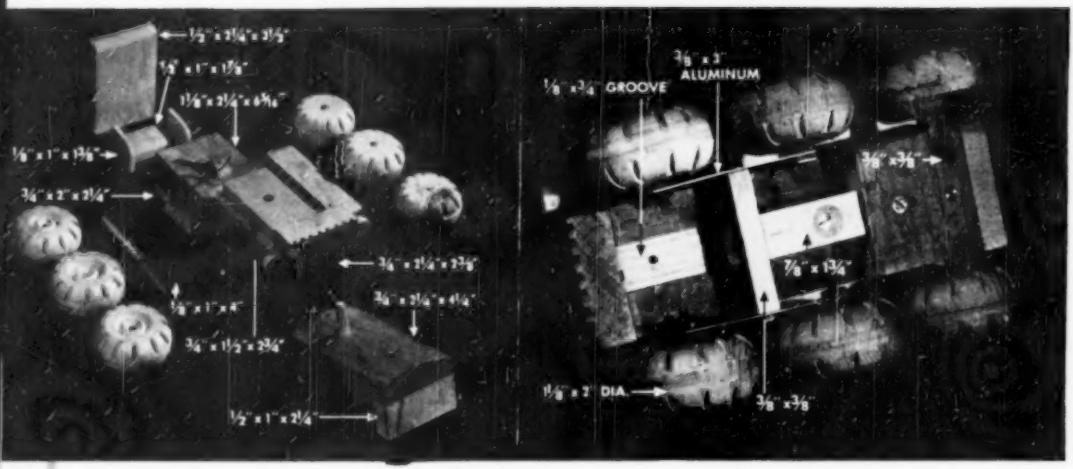
To make the six-wheeled tractor, Chugger the Tugger, saw out the block that forms the main body first and build around it. The photos give you construction details. You'll find it easier to sand all parts before assembling them.

The radiator is simulated by sawing out equally spaced 1/8" grooves. Attach it to the main body with dowels and glue. The dashboard and engine hood are assembled as a unit and then doweled to the main body. A screw through the engine hood and into the radiator represents the radiator cap.

Front and rear axles should be cut from hardwood. The 11/64" hole in the ends of each axle takes a 3/16" stove bolt. These bolts in a 11/64" hole are a good, tight fit—



Indoors or out, kids will have a lot of fun playing with this sturdy, six-wheel tractor.



the stove bolts cutting their own threads.

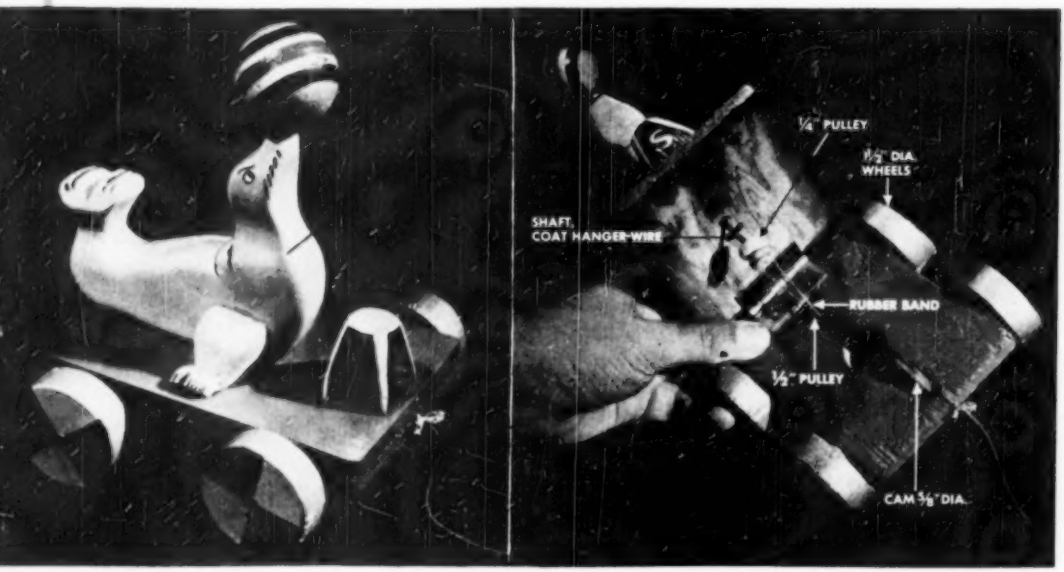
The hardwood wheels were turned on a lathe. If you don't have access to a lathe, you can substitute skate wheels, or perhaps wheels salvaged from old toys. The headlights were also turned but these could be carved by hand and sanded smooth. Heavy-gauge aluminum will do to mount the tandem front-wheel assemblies. A small screw eye makes a good trailer hitch.

Color of the paint job is optional, of course. This model was painted red with white hub caps, exhaust, and seat.

Henry R. Corry produced this tractor.

Trick seal that twirls ball is carving project.

To MAKE the seal, start by carving the body to shape. You can get the outlines of his body from the drawing on the squares. The model pictured here was carved from a block of pine. Flippers were cut out separately and attached with glue and brads.

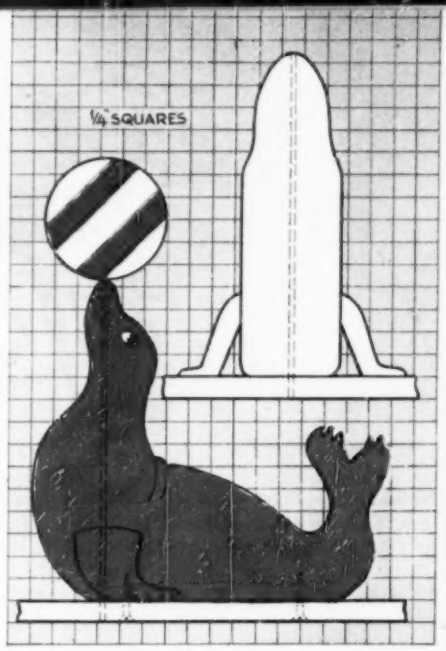


The seal sits on a 3¾" by 5" platform of ¾" plywood. This platform is hinged at the back to a base of the same size. As shown in the photo, a slot in the base provides clearance for the mechanism. A wooden cam, glued to the center of the front axle, causes the platform to rise and fall as the wheels of the toy turn. The center of the rear axle carries a ½" pulley that is connected to a pulley on the bottom of the drive shaft to turn the ball. Both pulleys can be made from spools. Drill straight up through the seal's body to make a hole for the drive shaft.

The wheels were cut out with a jigsaw and glued to the axles. Staples hold the axles to the underside of the base. For a ball, you can use either a rubber or wooden one—gluing it to the drive shaft.

Suggested colors are red and white ball, bright blue seal, silver base with red edges, and yellow and green wheels.

Sammy was built by Roland Cueva. END



Plating With AC Plus DC

An improved method of aluminum plating, reported to the American Chemical Society, employs AC superimposed on the DC conventionally used in plating. Effect of the odd combination of currents is to make the plated metal more adherent. The method produces aluminum-plated copper wire that can be flexed repeatedly without breaking the coating.

Wheels for Small Models

Rubber heels or soles on discarded shoes can be easily carved into real-looking wheels for small car or plane models. For working models on which the wheels must turn, insert a metal bushing that will fit the axle. If you can't find a bearing small enough, wind copper wire around a nail, slip it off, and press it into the center of the wheel. *—F. Mitchell, Simsboro, La.*

FINISHING INLAY

To apply a first-class finish to inlay work that includes many wood pieces of contrasting color, proceed as follows:

After sanding the inlay, apply a coat of white shellac, thinned one-to-one with the solvent mentioned on the container. This coating helps prevent discoloration of the light woods when you later apply wood filler. When the shellac has dried, brush on paste filler that you have thinned as directed. Wipe off the surplus with a soft cloth. Then let the filler dry about 48 hours until it is completely hard.

Next, sand with fine paper to smooth the shellac. Then brush on a second coat of shellac, using it full strength. When this has dried, sand again. Apply a light varnish or white shellac as the final coat. Any rubbing should be done with rubbing felt, using powdered pumice stone and oil.

FOR YOUR POPULAR SCIENCE INFORMATION FILE

Learn to Shoot

Nobody can hurt himself with this gun —which makes it a fine Christmas gift for a budding young marksman.

THIS gun shoots nothing but light. Any child can use it safely, yet it will test any man's marksmanship.

The target is a photoelectric device with a small bull's-eye window, above which a cardboard duck is poised. A straight shot topples the duck and rings a bell.

This target can be used up to 50 feet away from the light gun. It will also respond to a flashlight's beam, but sweeping the target with a steady beam wouldn't test your aim.

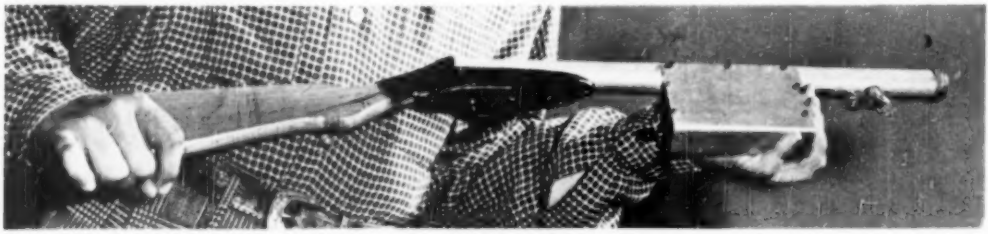
What the gun does: The gun (shown below) emits a quick flash of light when fired. The battery in it charges a condenser. Pulling the trigger lets the condenser discharge through the bulb. The 45-volt radio B battery lasts for months.

What the target does: The target responds to very small changes in the light striking it. The light's energy is converted into electricity and amplified a million times by a photomultiplier tube. This hefty charge is then fed to an OA4G trigger tube. When the charge on this tube reaches a predetermined level, the tube "fires" and energizes a relay. The relay, in turn, makes the target sound off.

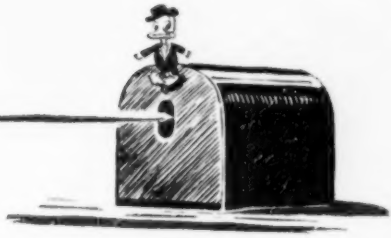
Making the gun: To make my light gun look real, I used the stock and action of a toy rifle and combined it with a barrel made from a 16″ length of ¾″ aluminum tubing. The toy gun's trigger works the lever of a rigidly mounted SPDT midget snap switch. When not triggered, this switch keeps the battery-condenser circuit closed so a charge can build up in the condenser. When triggered, it opens the battery circuit and puts the lamp across the condenser.

Any inexpensive lens can be used to focus the light. My lens is cemented to a cardboard tube that slides inside the gun barrel, and I focus the beam by moving the tube in and out.

The bulb must be a 6-8-volt, .15-amp., brown-bead pilot lamp; no other type will do. A standard radio-pilot-light assembly holds it partly below and partly inside the barrel, a few inches from the end of the muzzle, with its filament at right angles to the lens. Before drilling the bulb opening in the barrel, I determined the proper spacing by connecting the bulb to a 6-volt battery



Gun contains an instant-acting light circuit that fires one bright, brief flash. The parts include a 45-volt battery, a snap switch, a condenser, and a radio pilot lamp.



With Light

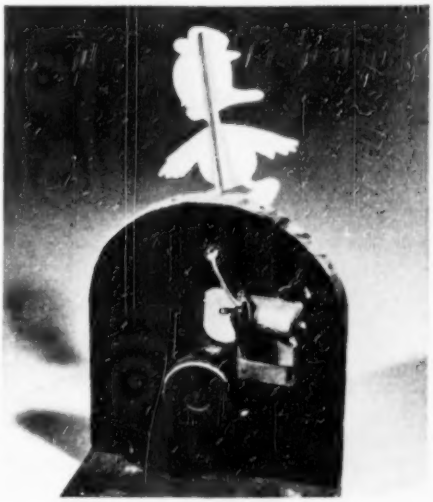
By J. Raymond Schneider
PS PHOTOS BY HUBERT LUCKETT

(to provide a steady glow) and moving the lens in front of it until the spot was focused on a wall 10 feet away.

Making the target: To get good results from the phototube in the target, you need about 1,000 volts. An ordinary 1,000-volt power transformer is pretty expensive, but a photoflash transformer will suffice. It will usually put out much more than the required voltage, however, so a dropping resistor (R1) must be used. R1 is a 2,000-ohm, 20-watt adjustable resistor. Connect it in series with the primary, as shown, and hook a high-range AC voltmeter across the transformer secondary. Adjust the tap on R1 until the meter reads 1,000 volts. If the full 2,000-ohm resistance still does not bring the voltage low enough, another resistor can be added in series.

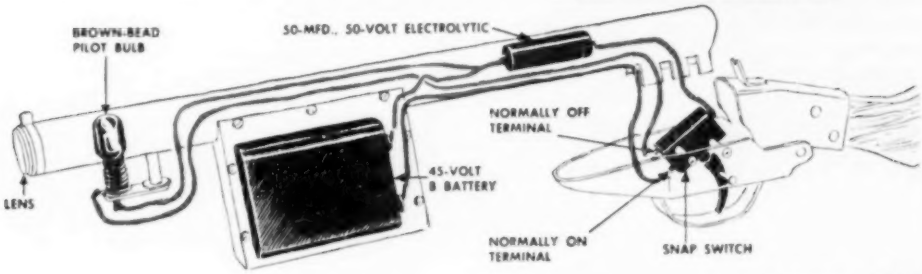
Other transformers with 10-to-1 or higher step-up ratios will also work. I used a Kenyon type T-2 microphone-to-grid transformer. If you use an audio transformer, however, be sure it is a heavy-duty unit that can handle fairly heavy currents in the primary.

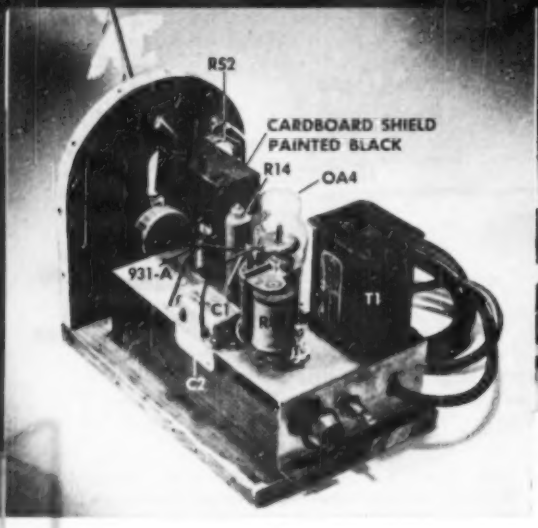
Both tubes used in this circuit are the cold-cathode type. They do not have heaters, require no filament current, and give

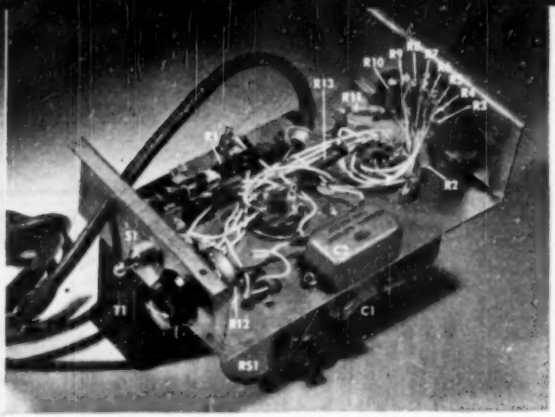


Bell mechanism can be scavenged from an old doorbell. When magnet coil is energized, hammer strikes bell. As clapper moves, pivot wire slips loose and duck topples down.

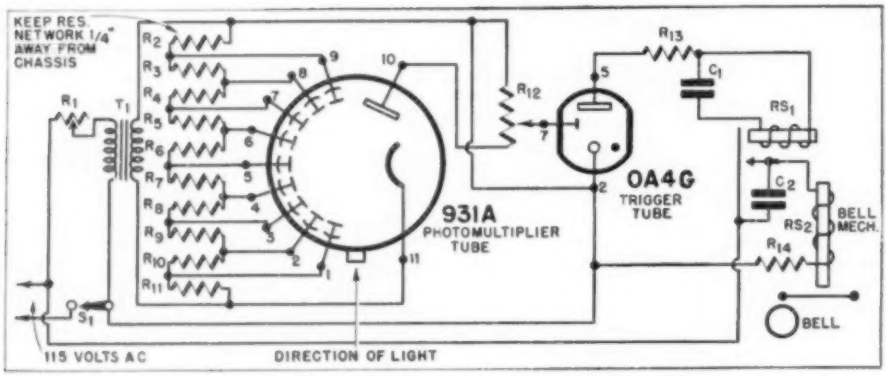
Gun construction and wiring are shown below. Toy-gun trigger trips switch lever. Be sure switch is rigidly mounted. Lamp filament should be at right angles to sliding lens.







Wiring isn't critical, and wide range of parts may be used. Scrap-box or bargain-counter components can save you money, but be sure their characteristics approximate those specified. Entire unit must be hooded against light.



LIST OF PARTS

R1: 2,000-ohm, 20-watt adjustable wire-wound.
R2 through R11: 39,000-ohm, ½-watt carbon.
R12: 200,000-ohm potentiometer.
R13: 1,000-ohm, ½-watt carbon.
R14: 50-ohm, 25-watt wire-wound.
C1: 1-mfd., 400-volt paper or bathtub.
C2: Same as C1, but .05 mfd.
S1: SPST toggle.
T1: Step-up trans. (see construction information).
RS1: 5,000-ohm, SPDT plate-circuit relay.
RS2: electromagnet from doorbell buzzer.
931-A photomultiplier tube and 11-prong socket.
OA4 cold-cathode trigger tube and octal socket.

long, trouble-free service. The resistor network, which breaks down the high voltage from the transformer into 100-volt steps, must be kept away from the chassis. The complete network is assembled on a plastic strip and mounted in ¾" spacers.

My bell-ringer was made from an old 6-volt doorbell buzzer. Dropping resistor R14 was used because the buzzer had a 6-volt coil. A 115-volt bell would do just as well and no resistor would be needed.

The duck was clipped from a magazine and pasted on cardboard. I covered my target with a sheet of metal to keep out light and placed a cardboard shield over the phototube (shown in the photo) to minimize the effects of stray light.

Final adjustments: To operate the unit, the bull's-eye window must be turned away from bright-light sources, and the sensitivity control, R12, adjusted until the trigger tube receives just enough current to cause the bell to ring. The control is then backed off until the bell stops. This leaves the circuit balanced on a fine edge so that it will go off when any extra light hits it. A flash from the light gun is plenty—provided your aim is true.

Is it? Why don't you build a shooting gallery and find out? END

Music Without Knobs

This child's phonograph runs itself and is never too loud—because dad sets the volume.

By Norman L. Chalfin

Executive Secretary of Associated Radio-Television Servicemen of N. Y.

Lifting the arm off its rest starts the machine.

EVERY father and mother—and child—who saw this phonograph being built and photographed wanted one like it.

It plays all sizes of standard 78-r.p.m. records. Lifting up the pickup arm to place it on a record starts the motor and amplifier; returning the arm to its rest shuts everything off. The volume cannot get out of hand, because you preset it, and the kids can't change it.

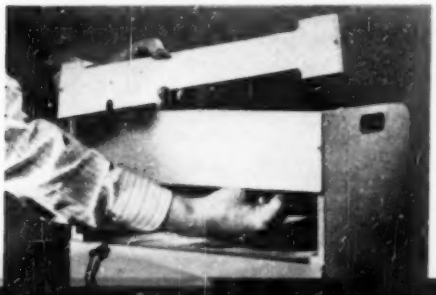
There is nothing comparable in New York City stores at any price—and the parts required to build this machine cost only $25.

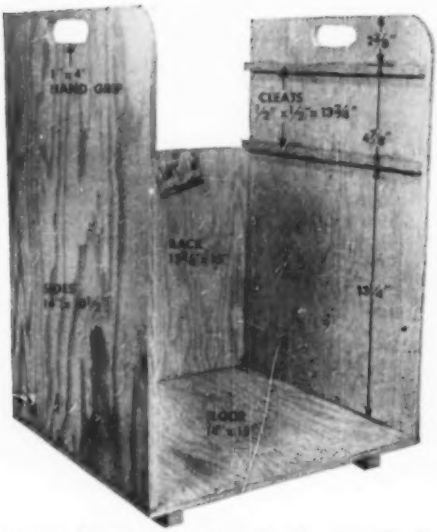
Amplifier is simple. The amplifier has so few parts it's a cinch to assemble and wire. It uses one tube—a battery or filament type—and a selenium rectifier. Together they give instant warm-up, so there's no waiting between turn-on and play. Parts aren't crowded even on a 4" by 5" chassis. There are only seven resistors besides the volume control, and the wiring is simple.

All specifications given here are for the 3V4 tube. The filter condensers C1, C2, and C3 may be in a single can, or two units as shown, or three separate parts. Instead of the 3V4 tube, you could use a 3LF4 (lock-in base), 3Q4, or 3S4. But if you use another tube, be sure to check the socket connections and also the load resistance of the tube, so that you can buy an output transformer to match. Some condenser and resistor values might also have to be changed.

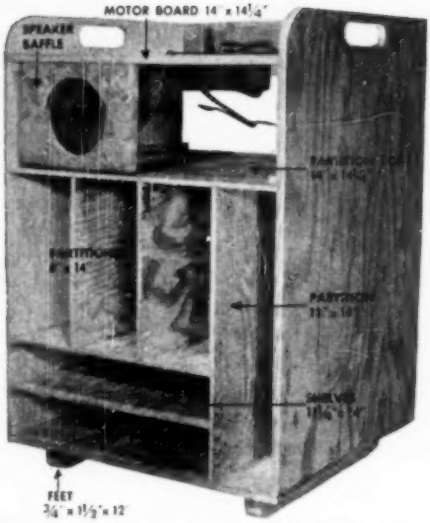
A high-output pickup is important. Make sure the cartridge you buy has an output of

To change volume, this rear panel must be removed. The notches in it are for ventilation.





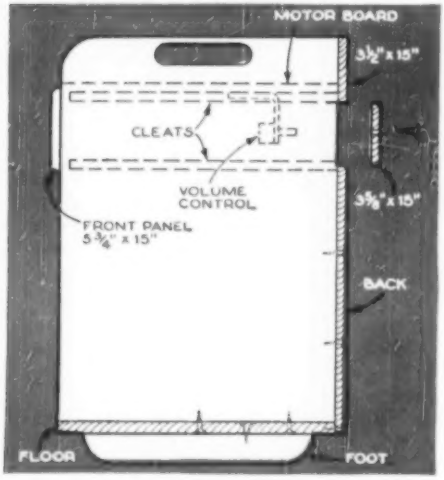
Secure the cabinet back with glue and wood screws after squaring sides with bottom. Bevel the edges of the back with sandpaper. Countersink all screws and set nail heads.



Use glue and 1" nails to assemble and hold in record partitions. Triangular glue blocks may be fitted under the shelves. Motor board carrying working parts lies on upper cleats.

at least 3.5 volts. The midget snap switch must have a light-pressure leaf or lever, so that it can be actuated by the weight of the pickup and it should be the normally closed type. If the spring leaf works too stiffly, you may be able to file it thinner, or to pivot the leaf instead. An even simpler switch might be made from an old phone jack or relay contact leaves, as shown in the drawing.

Too low a filament voltage will cause distortion. If your line voltage is low, experiment with a slightly higher value for R6.



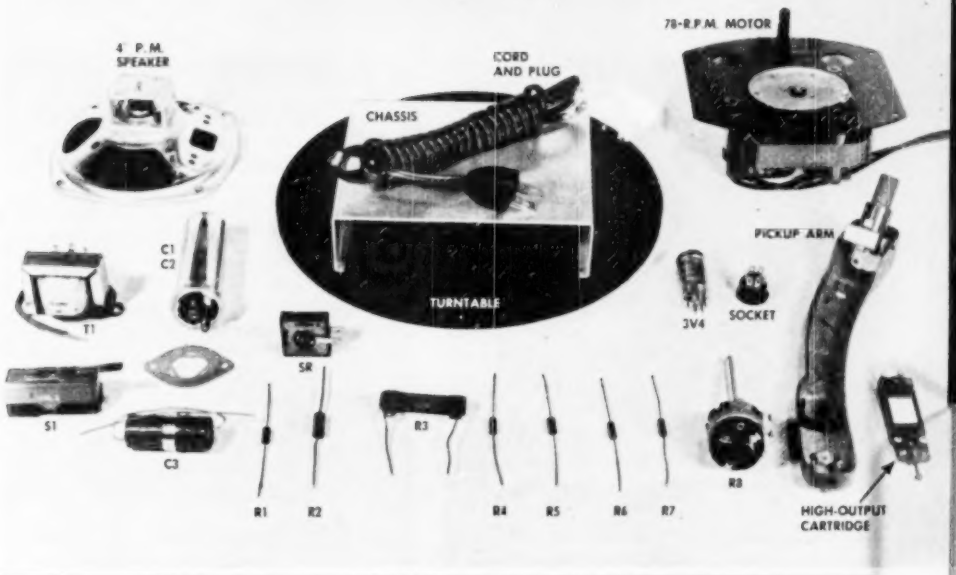
Cabinet is butt-joint job. You needn't be a whiz to build the cabinet. As always, power tools will save you time, but basically this is a hammer, saw, and screwdriver job, with not a mortise or tenon in a carload. The hardest part is cutting the pieces to size.

Although ¾" plywood was used for the carcass and ¼" plywood for the shelves in the cabinet shown, it's easier to use the ¾" thickness throughout.

By using a fine-toothed saw and taking care not to splinter the edges, you can save yourself some patching and filling. The handgrips in the sides can be omitted, but are handy when the cabinet has to be moved for cleaning.

First attach the two feet to the floor of the cabinet with glue and nails. Then drive a couple of screws through into each foot. Turn the floor upside down and scribe a line 3/16" from the two side edges. Drill countersunk holes along these lines for thin wood screws to go into the sides. Use plenty of glue on the end grain, locate the sides on top of the floor and flush with the edges, and secure with nails. Then drive the screws.

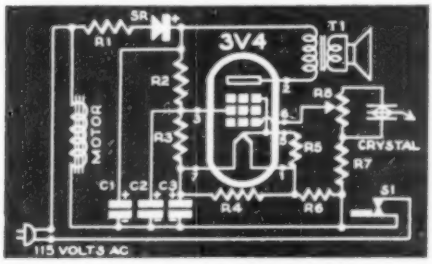
The back is the same width as the floor, and overlaps the sides, strengthening the whole structure. Drill countersunk holes



LIST OF PARTS

R1: 27 ohms, ½ watt.
R2: 150 ohms, 1 watt.
R3: 2,250 ohms, 10 watts.
R4: 250 ohms, ½ watt.
R5: 150 ohms, ½ watt.
R6: 68 ohms, ½ watt.
R7: 25,000 ohms, ½ watt.
R8: 500,000-ohm volume control.
C1: 80-mfd., 150-volt electrolytic.
C2: 40-mfd., 150-volt electrolytic.
C3: 100-mfd., 25-volt electrolytic.
T1: Output transformer; 10,000-ohm plate to 3-4 ohm voice coil.
SR: 65-ma. selenium rectifier.
S1: Normally-on midget snap switch.
3V4 tube, 7-pin miniature socket, 3.5-volt crystal cartridge and pickup arm, 4" PM speaker with 3-4 ohm voice coil, 78-r.p.m. motor and turntable, small chassis, line cord and plug, terminal strips, mounting bolts and nuts, hookup wire, ¼" bushing and nut, ¼" shafting.

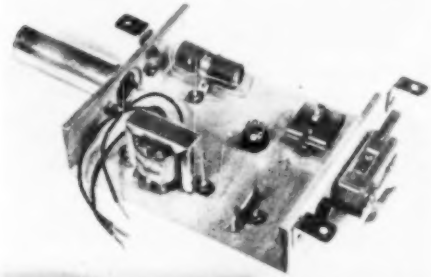
along two sides and the bottom of the back. Apply glue, and nail the piece lightly in place. Use a steel square, or measure the diagonals (which should be equal) to make sure the sides are square with the bottom. Then drive more nails and the wood screws.

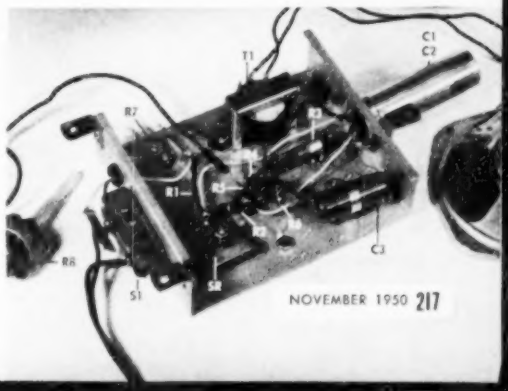


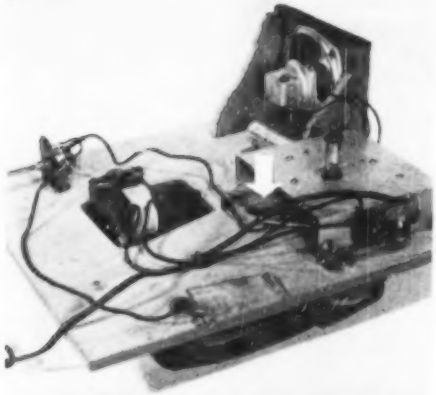
Glue and nail in four cleats at the heights specified in the photos. The top of the record case fits under the lower cleats. Glue alone will hold it, as it is supported by the partitions. Mark center nailing lines on the bottom, the case top, and the left-hand side where partitions are to go. Glue and nail together the two shelves and three partitions. Apply glue to the exposed ends, place the assembly in the cabinet, and nail it fast.

Record player is a unit. The phonograph motor, pickup, loudspeaker, chassis,

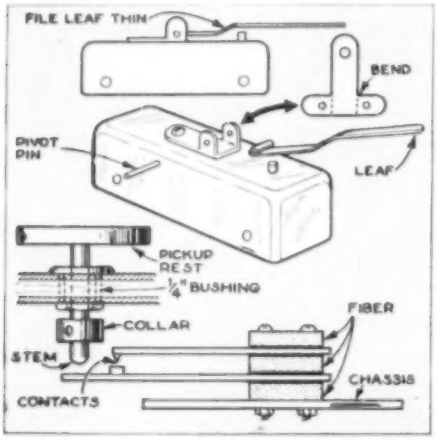
Small chassis is uncrowded. Speaker goes on baffle fastened to motor board, and volume control on angle bracket or small wooden panel.

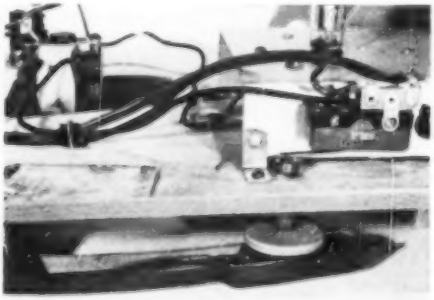






All sound equipment goes on one panel, here shown upside down. Volume control is toward the back. Cut a ventilating hole (arrow) above the chassis where it will be covered by the turntable. Tack screening over the hole.





This upside-down closeup of the pickup rest and snap switch shows how they work. A collar fastened on the stem under the panel keeps the pickup rest from being pulled out.

and controls all go on the ⅜" motor board, which should be made an easy drop fit between the sides to rest on the upper cleats. It's held by two wood screws in each cleat. Thus it can be lifted out as a unit if repairs are necessary.

It's safest to cut a piece of cardboard the size of the motor board and make a trial fitting of the parts on this to determine the proper spacing. Try a 12" record on the turntable to be sure it clears the sides.

Locate the chassis so that the end of the snap-switch lever comes about 1½" behind the end of the pickup head, and at least 1" inside the edge of the board. The chassis is mounted upside down with angle brackets as shown, the tube hanging down. Mount the volume control toward the back where you can reach in from the rear of the cabinet to set it after the player is mounted.

The speaker baffle can be soft fiberboard or plywood, mounted with two plywood brackets held on by wood screws.

Cut a hole in the plywood front panel directly in front of the speaker. Nail this panel on with glue along the side and bottom, but not to the motor board.

Pickup triggers power. When not in playing position, the pickup lies on a round rest affixed to a stem that works on the switch lever. Cut a small disk out of plywood, centerdrill it just under ¼", and drive in a bit of ¼" radio shafting or plastic rod. Mount a threaded ¼" bushing (obtainable at radio stores) on the panel. Glue a soft eraser alongside the turntable for the pickup to drop on if it's pushed off the rest.

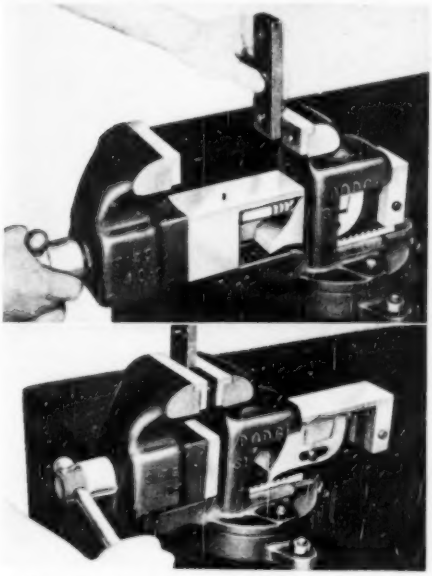
Bear in mind that the chassis is electrically hot. Therefore don't let it touch the pickup arm or the motor under the panel, and be sure to mount it with short wood screws that do not project above the panel.

Final touches. Sand the cabinet well, particularly along the edges, first filling any core holes, as well as splintered areas and nail and screw holes. Follow with your own favorite finishing schedule for plywood or those given in a previous article (PS, Dec. '49, p. 185). The cabinet shown was sprayed with lacquer. A trim color was applied to the turntable compartment and to all edges.

Tack a bit of screening in front of the baffle to keep the youngsters from poking anything into the speaker cone, and glue a piece of cloth over the screen. Fasten the motor board in place. Then watch the children take over. END

Vise News

Spinning Handle Eliminated



You can close or open this 58-lb. vise by pushing or pulling. You don't have to spin the handle.

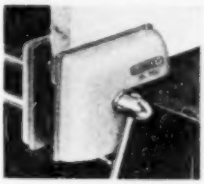
The top photo shows the vise ready to be closed on the work. The handle is moved one and a half turns counterclockwise, putting the vise in neutral. Then a push closes the jaws on the work. When the jaws contact the work (bottom photo), the vise operates in a conventional manner. A turn of the handle clockwise applies full pressure.

The maker is the Dodge Manufacturing Corporation, of Mishawaka, Ind.

Clamping Device Costs Little

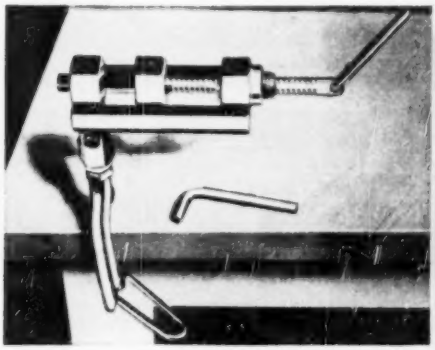
Work up to 3" thick can be wedged in this vise for planing, sawing, drilling, filing, or sanding. It's priced at $1.75 by the Barron Tool Company, of Detroit, Mich. The vise consists of two die-cast aluminum angular pieces. One piece attaches to a bench, while the other slides along on top to wedge the work in tight.

Work Held in Two Positions



The L-shaped jaws of the vise at the right, made by Stanley Tools, New Britain, Conn., hold the work on top of the bench or at one side. The vise is especially useful for woodworking, leather craft, metal craft, and plastics. The jaw faces are lined with composition board that can be replaced when worn out. Jaws open to 3½".

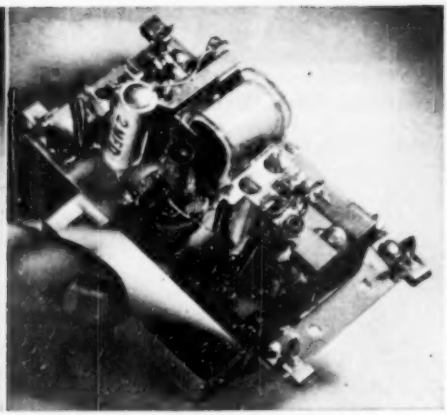
Model Makers Will Like This



You can position this small vise, made by Mechanics Engineering Co., Jackson, Mich., at almost any angle to make gluing, soldering, and fabricating easier. The body of the vise can be positioned anywhere within 360° horizontally and also within an arc of 180° vertically. Turning the handle to the left opens the jaws to their full 2¾" capacity. The vise closes quickly when you set the jaw against the work and lock it with a quarter turn of the handle. The Bar Lok Hobby Vise is priced at about $10.

Has Three Bearing Surfaces

This swivel-base milling-machine vise is made in three sizes—3", 4¾", and 6¾"—by the L-W Chuck Co., Toledo, Ohio. The sliding jaws have full-length bearing on a ground bar and two machined ways. Four bolt and key slots are provided for attaching the vise to the machine table. Weights of the models, complete with crank, are 16, 40, and 85 pounds.



Now Anyone Can Control His Models by Radio

HAVE you ever dreamed of controlling a model boat or free-flying plane by radio—only to be stopped because you had to get a "ham" license?

With the hand-held transmitter at left above and the 5½-oz. receiver at right, you can now operate such models over any distance up to half a mile away. And you don't need a "ham" license.

You *do* need a license, but it's obtained just for the asking. This is because the outfit itself complies with regulations set up by the FCC for the 465-megacycle Citizens Radio Service.

The transmitters and receivers are sold separately for about $40 each. This makes it possible for a club to buy one transmitter to control several models. The receiver measures 2¼" by 2½" by 3¾".

The Vernon C. MacNabb Co., Indianapolis, which makes the units, also plans to sell them for use in garage-door openers.

Shellac Protects Wallpaper

WALLPAPER around light switches and doorways can be protected from finger marks by brushing on a thin coat of white shellac. The shellac will leave the colors of the paper unchanged, but you'll be able to wash away any smudges with a damp cloth.

MATCHING AUTO PAINT

After a few years, the original paint on a car may change color slightly. To get a perfect match, the Arco Company, of Cleveland, suggests tinting its new paints as shown. Add the tinting colors slowly.

IF NEW COLOR IS ⇄	Too deep, add:	Too light, add:	Too green, add:	Too red, add:	Too yellow, add:	Too blue, add:	Too "dirty" (grayish), add:
Gray	white	black	white and oxide red	medium green	white and touch of blue	medium yellow and red	white and blue
Blue	white	deep blue	deep maroon	medium green	deep maroon	med. yellow and red	white and blue
Green	white or yellow	med. green or blue		blue, med. yellow and med. green	blue	med. yellow and red	medium yellow and blue
Red	white and cadmium red	oxide red or light maroon			light maroon	oxide red	light maroon and touch of white
Maroon	light maroon or cadmium red	deep maroon			deep maroon	light maroon or med. yellow	deep maroon and touch of white
Yellow	white or medium yellow	medium yellow	white and touch of cadmium red	white and light green	white		white and medium yellow
Brown	white and orange or burnt sienna	black, medium yellow and oxide red	oxide red or burnt sienna	light green and burnt sienna (add white if necessary)	oxide red and black		yellow and oxide red and touch of orange

FOR YOUR POPULAR SCIENCE INFORMATION FILE

This couple is testing a TV set in a store. He is trying one of eight POPULAR SCIENCE tips—wrapping the antenna lead-in around an electric shaver to test the sync circuit. Good sets show no interference, or only fine black streaks (left). On poor sets, the picture "tears" (right).

8 Tips on Judging a TV Set

These simple tests that anyone can make will help you get your money's worth.

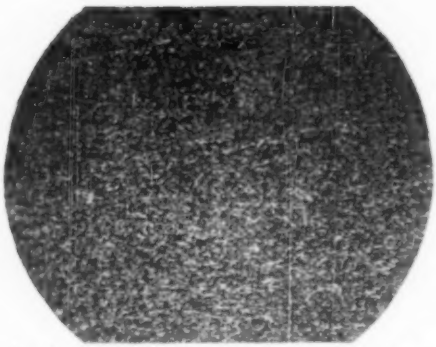
ASK the television "experts" and they say, "Test a TV set? Uh-uh! Only a specialist can do that. Play safe and buy a name brand from a dealer you know."

Naturally, it's a good idea to stick to reputable manufacturers and honest retailers. But even the best factory can turn out a lemon. And relying wholly on this advice might lead you to pass up a really good buy in a make you had never heard of before.

The truth is, you *can* test a TV set without being an electronics engineer, without knowing a cathode-ray tube from a transformer, without even looking at the works. You wouldn't spend your money on a new kind of car until you checked the specifications and road-tested it. You don't need an engineering degree or a lab full of apparatus for that. Well, the same thing applies to television. You can find out a lot about a TV set's quality with just your eyes and ears.

If you want to know more than picture size and cabinet appearance when you lay down $150 or more for parlor fun, here's what to do. Follow these eight tips for intelligent TV shopping.

Interference: black or white? Automobiles and gadgets like electric shavers sometimes interfere with the TV picture. In a good set this interference—if it shows at all—will appear as horizontal streaks of black dots. But if the manufacturer has cut too many corners in the circuit, the black dots will have white tails, and the whole picture may "go out of sync"—start flipping down the screen. A good way to check this point is to take an electric shaver with you while shopping. Just plug it in, twist the set's an-



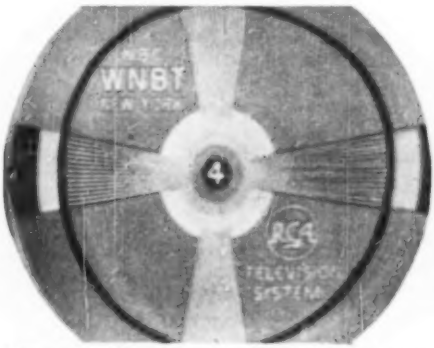
You want all stations. Sets with enough power usually can make "noise" show as pattern of dancing specks (above) when contrast is up on vacant channel. Weak set gives picture at left.

tenna lead-in around it, and watch what happens to the picture.

Gain enough? Well-designed sets usually have enough gain—amplification power—to make the circuit's inherent noise (natural random movement of electrons) visible. There's an easy way to check this (see the photos above). Turn the station selector to a vacant channel, and then twist the contrast knob all the way up (be sure it's the contrast, not the brightness, that you turn up). If the screen is covered all over with dancing black and white specks, okay. (The dancing specks are noise.) If the screen is just a smooth gray crossed by diagonal white lines, beware. Lack of gain isn't serious if you live in the city near the transmitters, but if you're a country dweller far from the stations, it's very important.

Can you see the lines? Television pictures don't *have* to be fuzzy. Make sure yours aren't by checking the set's *resolving power*, as shown at bottom of this page. Tune in a test pattern and look at the wedge of converging lines that points down from the top of the picture. You should be able to distinguish the individual lines in the wedge nearly all the way down to the white circles in the center of the test pattern. (All test patterns aren't alike, so try this test with several stations, or use the same test pattern to compare two sets.) Even inexpensive sets should meet this test. Don't try to judge resolving power from the sharpness of station call letters—use the converging lines.

You don't want twins! By cheapening the vertical synchronizing circuit, some manufacturers introduce a defect that—to the uncritical eye—seems to improve the sharpness of the picture. Actually, it leaves out half the detail that should be there. As you know, a video picture is made up of 525 horizontal lines. The electron gun "paints" half of these during one "trace," then goes back and "interlaces" the other half. On a good set, the interlaced lines will



You want sharp pictures. Think the one at left is good? Wrong. Lines in vertical wedges blur, indicating poor resolution. Set above is a good one, gives sharp lines, but has poor antenna.

You want proper contrast. No question here about which picture is better. So check the sets you shop by looking at facial tones, or better, at the shaded circles on a test pattern.

be exactly midway between the lines of the first trace. On a poor set, they may vary from this midway position, "twinning" (also called "pairing") with the first-trace lines. Sometimes they will even merge with the first-trace lines, disappearing completely. You can check for twinning by tuning in a station, turning the contrast down and the brightness up, and moving the vertical-hold knob back and forth a little. But you'll have to look closely, for the lines are very fine.

Tattletale gray? Insist on pictures that are really black and white, not just muddy shades of gray. Note the difference in the pictures at the top of this page. The faces in "live" shows should look natural, but don't expect this in most telecast movies. For a better check, examine the test pattern. It has a set of concentric circles that should range from solid black to pure white, with sharply different shades of gray in between. A "black" picture tube (the glass face is tinted gray) helps tone rendition a lot.

Circles or eggs? Watching many a TV set, you'd think all video actors were short and fat. 'Tain't so. And they don't have to look that way on your set if you choose it carefully. Look at the big circles on a test pattern. These should be real circles, not eggs or other out-of-round shapes. To some extent, out-of-roundness may only be poor adjustment of the height and width controls, but don't count on it. Anyway, you should expect a good new set to be properly adjusted at the factory.

High voltage high? Ask the salesman how much voltage is supplied the picture tube. It should be somewhere close (in kilovolts, or thousands of volts) to the diagonal dimension of the screen. Thus a 10-inch set should have eight to 10 kilovolts, a 12-incher around nine to 12 kilovolts, and so on. Don't expect big sets—16 inchers or above—to have more than 14 kilovolts, which is the maximum considered safe in home receivers. But watch out for cheap, under-

You want normal proportions. The big circles on a test pattern should be circles, as at right, and not eggs or other odd shapes, as at left. Maybe this fault can be fixed easily, maybe not.

powered sets; the picture will be dim and the highlights may blur.

How's the sound sound? Try it out by listening to music from a "live" show originating in the station you pick up. Few inexpensive TV sets have really good audio systems, but some are better than others.

These eight tips do not make up an exhaustive performance test for a TV set, but they will help you pick the best from a selection of three or four. Ideally, they should be tried in your home. Television sets usually work better at home than in the store (because of better antenna, less interference), so this point isn't too serious.

Among the many other things to consider when buying TV, don't forget the obvious ones:

- the cabinet—it'll be the center of all eyes in most living rooms;
- and the screen size—a small screen restricts the audience and usually requires shifting of furniture for comfortable viewing (but a big screen doesn't necessarily mean high quality).

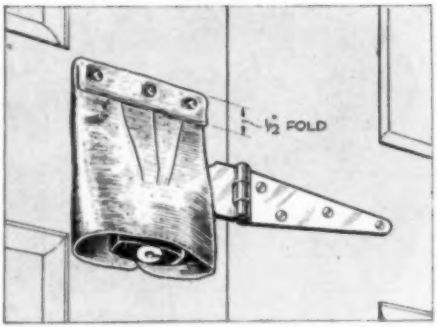
Rectangular picture tubes are being offered in many of the new sets. They don't work any better—or worse—than the round ones, but they are easier to fit inside cabinets, reducing the retail price. They also show all the picture, which round tubes seldom do (although they can).

The Famous 630 Chassis

You'll hear a lot about the "630 chassis"—a 1946 30-tube circuit designed by RCA and used by many manufacturers. Servicemen, particularly, will often tell you it's the only one to buy. The 630 *was* a good set, but RCA is the first to say it is now outmoded. Today's circuits are simpler, cost less, yet do a better job. Servicemen, always suspicious of new tricks, like the 630 because it is the type they're familiar with.

Another phrase the "experts" toss around glibly is "intercarrier sound." This refers to a method of using the same amplifying system for both picture and sound, instead of separate amplifiers, which costs more. Half the experts maintain intercarrier sound is terrible. The other half say it's excellent when designed properly. The best advice for the ordinary TV shopper seems to be buy the set that performs well, and don't worry about how the designer made it perform that way. END

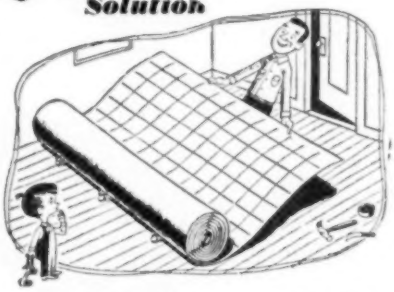
Next month* POPULAR SCIENCE *will report "What You Should Know About TV Antennas."



Glove Shields Lock from Frost

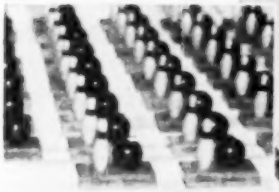
FROZEN padlocks on garage and barn doors used to cause me a lot of trouble. I licked this chronic winter problem by turning a couple of old snap-fastener gloves into lock protectors. I shield a lock from rain, sleet, and frost by cutting the fingers off a glove and nailing the leather above the padlock hasp. To get at the lock, I just unsnap the button and lift the glove.—*Anson R. Durant, Contoocook, N. H.*

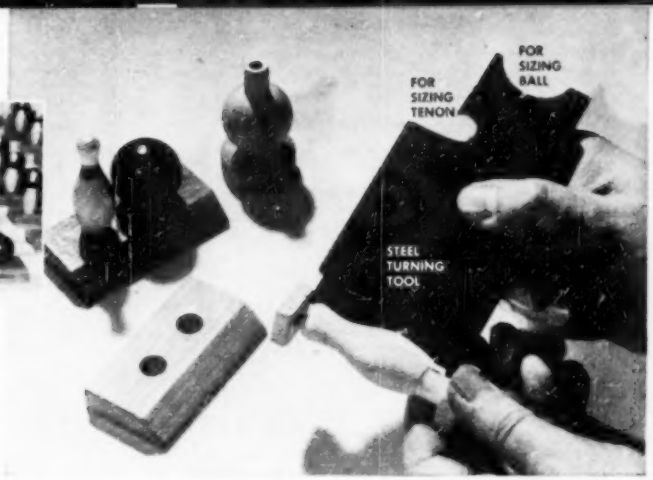
My Most Ingenious Solution



Wrestling with a heavy roll of linoleum is no fun. I know from past experience. So last month when I laid new linoleum on our kitchen floor, I tried a trick that let me easily unroll the linoleum as I needed it. What did I use?

I took my kids' roller skates, turned them upside down on the floor, and placed the roll of linoleum on the skate wheels. Then I was able to unroll easily as much or as little linoleum as I needed for cutting and fitting, the heavy roll riding on the skate wheels.—F. W. McIntyre, Milan, Ohio.





Rows of finished souvenirs (above) are ready for distribution. The steel form tool (right) that Harold Jackson designed turned out both pins and balls and shaped mounting tenons.

Your Shop Can Be a Souvenir Factory

SOME workshoppers—like Harold Jackson, of Kankakee, Ill.—turn their hobby into dollars.

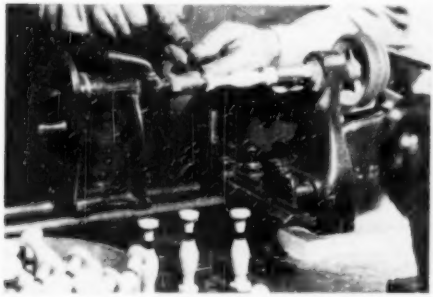
Jackson's home shop isn't set up for production-line jobs, of course. But when he got an order for 60 three-part souvenirs for a bowling club, he designed and built a special tool that turned his lathe into a semi-production line.

He used a 3" by 5" piece of ⅛" steel to make his form tool, sawing and filing it to shape. One end sizes the pins, the other end the balls, and a notch in one side fashions the tenons on both the pins and balls.

Jackson turned the 2¾" pins from blocks of white pine. He sawed up a 1⅜" drapery pole and turned the balls from the pieces. To speed operations—he turned out 60 finished souvenirs in three evenings—he roughed out the pins and balls with a narrow ⅜" chisel and then cut them to their final size with his form tool.

After sawing and mitering the base blocks to shape, he quickly drilled the holes with a simple boring gauge clamped to his drill-press table. Both pins and balls were sanded while turning in the lathe. He painted a red stripe on the pins with a narrow brush while the pins were chucked in the lathe and the spindle rotated by hand. The balls were finished with black lacquer. Then the ends were cut off balls and pins, a little glue was dabbed on the tenons, and they were mounted in the bases.

Similar souvenirs for other sports, Jackson suggests, could be a miniature football mounted on a base between goal posts; a pair of baseball bats and a baseball, or even a basketball and a goal.



Pins were turned to rough shape with narrow chisel. A form tool finished them and assured uniformity. Boring gauge (right) speeded drilling of base blocks. Gauge, of ¾" plywood, was designed so holes were properly located by sliding base blocks from one end of gauge to other.

Are You Taking TV Snapshots?

MANY POPULAR SCIENCE readers are. And they're getting good ones.

Below is one of about a dozen that Stuart Sylvester, of Brooklyn, N. Y., shot during a single evening. Ransom Sherman is NBC's Mr. Unfixit. He shows you on the television screen how NOT to do home and shop repairs of the type described in this magazine. The results are always funny.

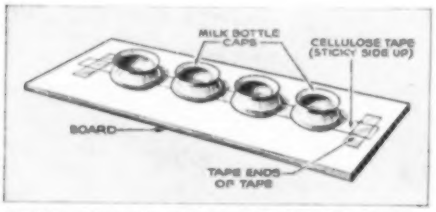
Funnyman Ransom Sherman

This photo was taken at 1/25 second at f/3.2. The camera was a Ciroflex with an Argus 1-D portrait lens over its taking lens.

POPULAR SCIENCE will publish more good TV shots next month.

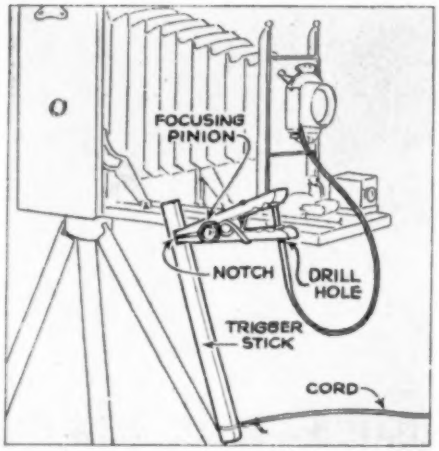
Non-Droop Finish for Candles

CANDLES used for decoration, and not required to burn, will not droop or bend if given a coat of shellac. To be cleaned, they need only be wiped with a damp cloth.



Milk-Bottle Caps Hold Paint

CRIMPED paper caps from milk bottles make good receptacles for mixing small amounts of paint. Stick several of them to a strip of cellulose tape, and then tape the ends to a board—or set one cap in each well of a cupcake tin. When you are through painting, you have no clean-up job. Just throw away the caps.—*F. Lettino, Astoria, N. Y.*



Clothespin Snaps Your Photo

HERE'S an easy and inexpensive way to get into your own pictures by remote control. When you pull the cord, the trigger stick falls off the clothespin. The pin snaps together, pressing the cable release. The clothespin is slipped over the focusing pinion.—*Hallie H. Holt, Springfield, Ill.*

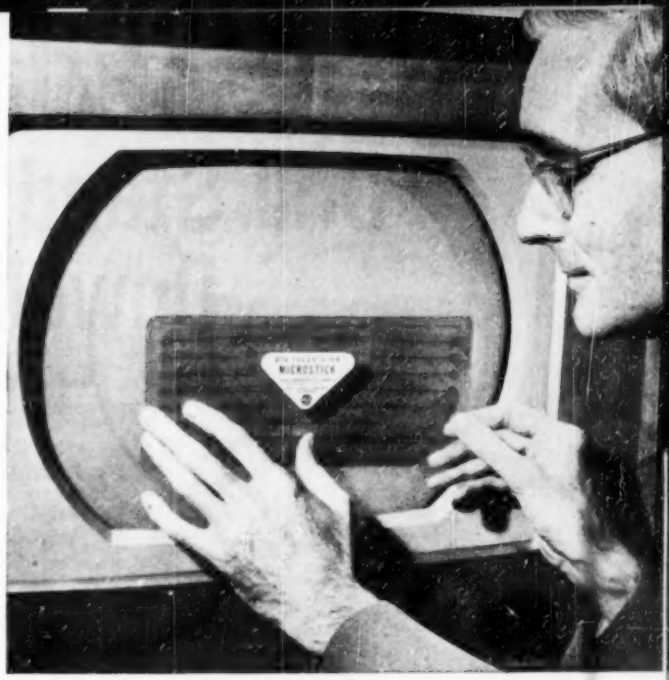
Blacking Brass Camera Parts

IF YOU make or remake camera parts from brass, you can give the metal a dull black optical finish in a couple of ways. One method is to dissolve scraps of copper in nitric acid until no more copper will dissolve. Dip the brass part in the solution, then hold it over a gas flame until it turns black.

Another procedure is to soak the brass in a solution consisting of 1 qt. water, 2 oz. lead acetate, and 4 oz. photographer's hypo. No heating is required.—*Henry Hanscom, Elmhurst, Ill.*

Ruler Measures TV Set's Woes

A NEW service tool developed by RCA helps TV technicians locate receiver troubles. With it the picture on any size of tube can be divided into fifty-thirds, representing the 53 millionths of a second that it takes an electron beam to cross the face of a picture tube. Called a Microstick, it can be used to determine the bandwidth of a receiver, calibrate a test-pattern wedge, measure interference frequencies, and find the air distance from reflecting objects that cause ghosts.



Heat Renews Carbon Paper

CARBON paper isn't always used up when it seems to be. Even after repeated use appears to have taken off most of the blacking, you can frequently renew the life of the sheet by holding it under a strong light. The heat softens the wax binder.—*Jean Paul Sirois, Cowansville, Que., Can.*

It's a steel grip attached to leather, worn like a glove over the palm of the hand. It adds to the security of a handgrip for tree and pole climbers, and makes it easier to handle large cakes of ice, sides of beef, heavy timber, or baled products.

Envelope Holds Carbons

TRYING to feed seven sheets of carbon paper and eight sheets of typing paper in my typewriter was a problem. The carbon and the paper would not grab evenly. I slipped an envelope over the ends of the papers, fed them through the machine, and then removed the envelope.—*Bruce S. Wilkinson, Beverly, Mass.*

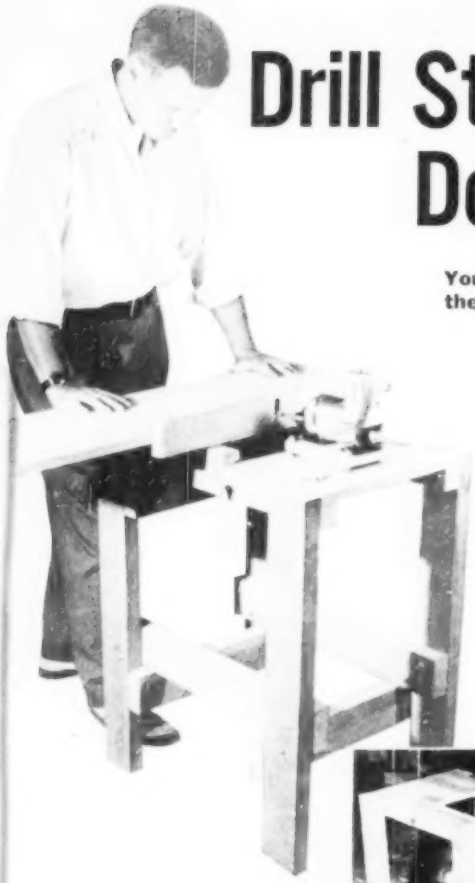
Drill Stand Makes Doweling Easy

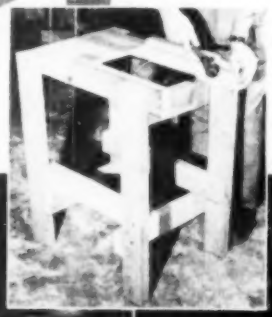
You can build it for $10 and increase the usefulness of any electric hand drill.

By Roland Cueva

BORING accurate, identical holes for dowel jointing is tedious work without a doweling machine or special drill jigs. But any electric hand drill with a ¼" or ½" chuck can double as an efficient doweler in combination with this stand.

The drill is held solidly in its stand by a setscrew in the hole that is found in the back of most drills of this type, but can be removed quickly when needed elsewhere. The stand itself forms a permanent piece of shop equipment, and drawers or a cabinet can be built into the lower part.





Carriage bolts—being tightened in photo at left—fasten legs to top rails and stretchers. Cross stretchers are held in place with large wood screws. Stretchers, legs, and top rails are sawed from two-by-fours.

Hard-fiber airplane pulleys provide smooth, straight, floating ride for the work table. Nuts allow for level and ride adjustment.

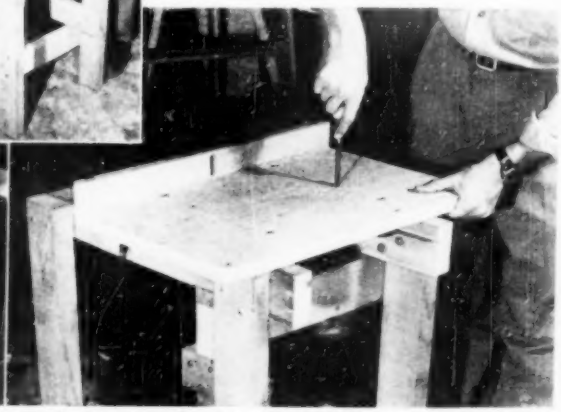


Table top is made of two pieces of plywood—¼" and ¾" thick. Nuts for the pulley shafts are countersunk in top of the table.

How it works. The table, carrying the work held against a fence, moves forward into the drill. The drill passes through a slot in the fence. A centerline lines up the work, and a spring underneath automatically pulls the table back after the hole has been drilled.

The drill carriage is adjustable vertically to handle work from ½" to almost 3" thick. Possible depth of hole varies from about 2" with a ¼" bit to upwards of 3", depending on drill size. This is adequate for nearly all furniture work, and makes the stand a useful addition to your home workshop.

Construction. Building this outfit is simple. Readily obtainable parts are used throughout, and cost should not exceed $10. This compares to $150 or more for a commercial doweling machine.

Care must be taken, however, to get the table and drill carriage level and perfectly aligned at right angles to each other. This is the only critical part of the job.

Pulleys. Start by cutting the two top rails on which the worktable rolls back and forth. These are grooved for the pulleys that act as wheels to carry the top. They are cut down at one end where the carriage table is set in. Cut the grooves on a circular saw if possible so they will align correctly. As shown in the drawings, they are made to fit ½"-thick, hard-fiber airplane cable pulleys that are mounted horizontally on the underside of the worktable. These pulleys are ideal because they are extremely tough, have precision center bearings, and come equipped with shafts and nuts. But any similar wheels or pulleys about 2" to 3" in diameter with non-wobbling center bearings can be used.

WHAT YOU NEED

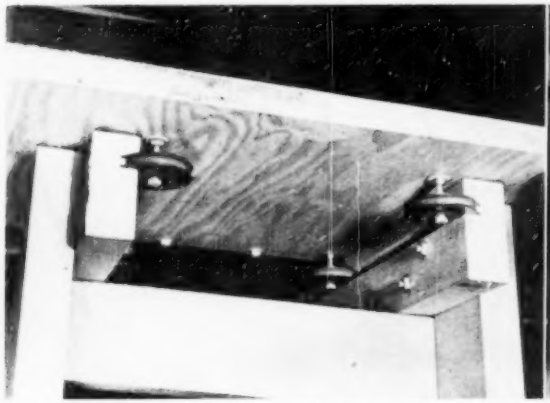
Two-by-fours	24'
¼" plywood	15" by 24"
¾" plywood	25" by 38¾"
4 pulleys	½" by 2½" dia.
strap iron	2 pieces ⅛" by 2¼" by 4"

4" C clamp, carriage bolts, screws, and ⅛" i.d. tubing.

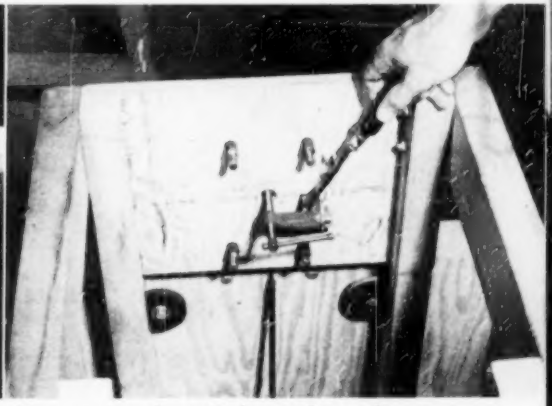
Drill-carriage table. Cut this from ¾" plywood and join it to the top rails with 1¾" No. 10 flathead screws, three on each side. Next, cut legs and stretchers from a two-by-four. Bolt and screw them together with the top-rail assembly.

Worktable. Clamp together two pieces of plywood, ¾" and ¼" thick (it doesn't matter which is on top), then drill the holes for the pulley shafts. Enlarge the holes in the ¼" piece to ¾" so the tops of the shafts will be countersunk. Cut the fence from ¾" oak or other hardwood and slot it in the center as shown. Screw the ¼" top piece of plywood to the ¾" piece with ¾" No. 6 screws, heads sunk flush.

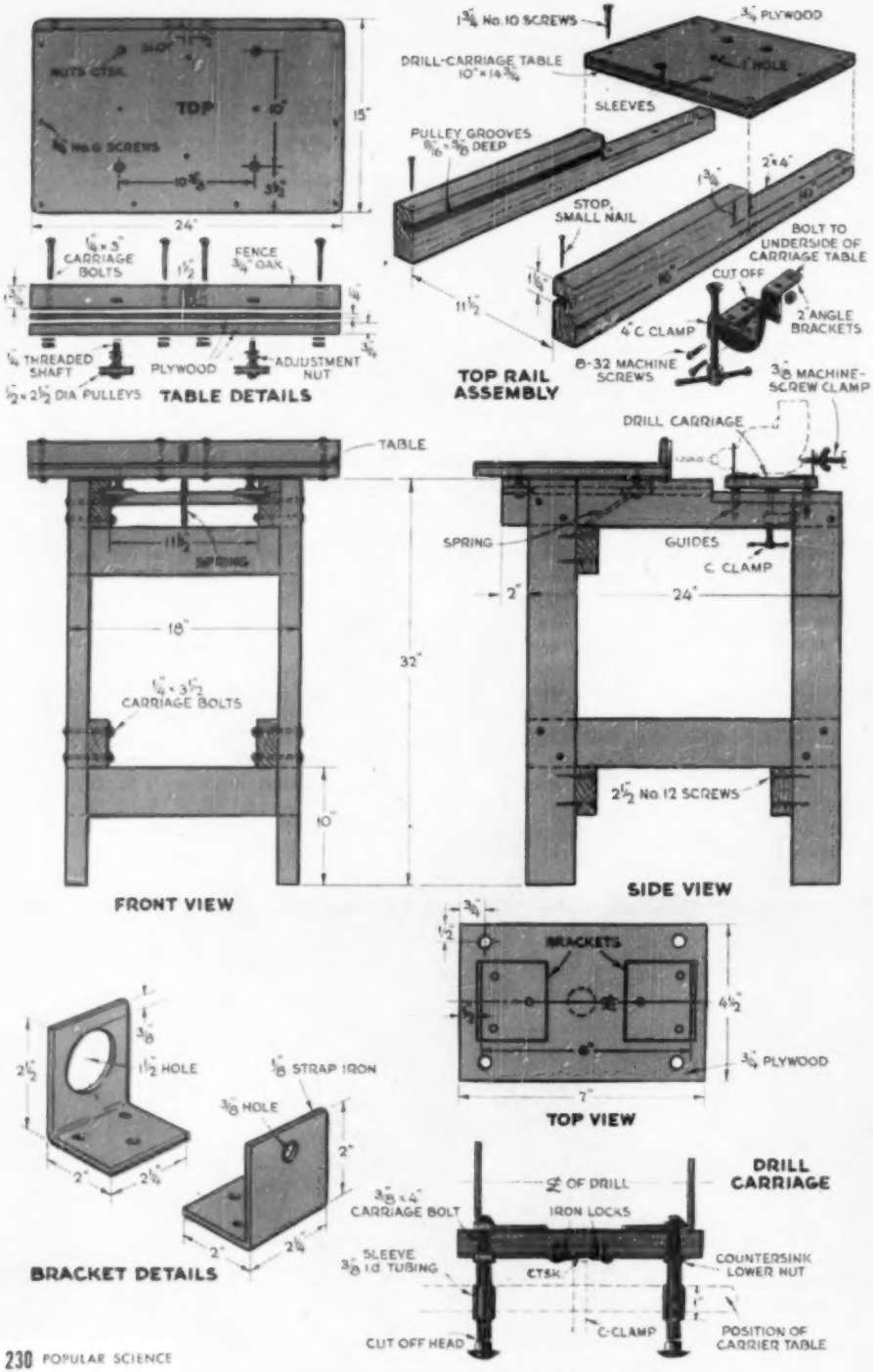
Then fasten the fence with four ½" by 3½" carriage bolts. Run the pulley shafts through the holes and tighten the nuts above and below the table. Place the table on the stand in its grooves and try it for height and motion. It should slide back and forth smoothly with no side play and float just above the top rails. Use the nuts on the

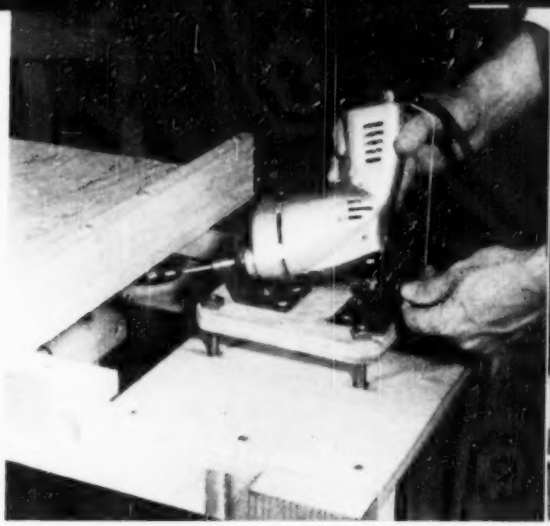


Pulleys work like this. Wood in center of grooves engages hollows in pulleys, but is not essential and is not shown on drawings.

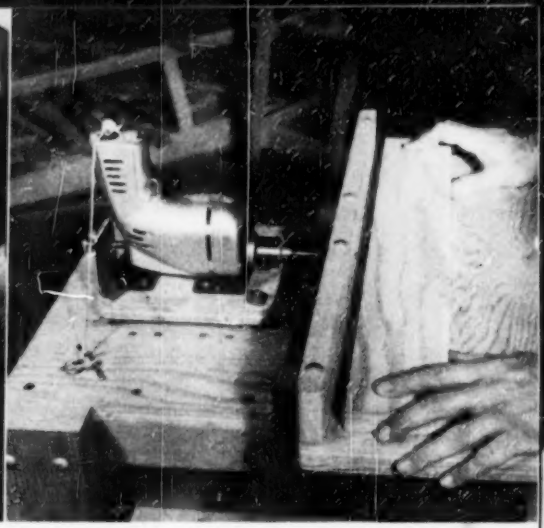


Bottom view shows C-clamp adjuster for carriage, the guides in their sleeves, and the spring that retracts the worktable.


SLOT
NUTS CTSK.
TOP
10"
15"
No. 6 SCREWS
24"
1¼" x 3" CARRIAGE BOLTS
FENCE ¾" OAK
1½"
¼" THREADED SHAFT
PLYWOOD
ADJUSTMENT NUT
½" x 2½" DIA PULLEYS
TABLE DETAILS
1¾" No. 10 SCREWS
¾" PLYWOOD
DRILL-CARRIAGE TABLE 10" x 14¾"
1" HOLE
SLEEVES
PULLEY GROOVES 5/16" x 5/8" DEEP
2"x4"
1¾"
STOP, SMALL NAIL
BOLT TO UNDERSIDE OF CARRIAGE TABLE
CUT OFF
11½"
4" C CLAMP
2" ANGLE BRACKETS
8-32 MACHINE SCREWS
⅜" MACHINE-SCREW CLAMP
TOP RAIL ASSEMBLY
TABLE
DRILL CARRIAGE
SPRING
GUIDES
C CLAMP
2"
24"
11½"
SPRING
18"
32"
¼" x 3½" CARRIAGE BOLTS
10"
2½" No. 12 SCREWS
FRONT VIEW
SIDE VIEW
¾"
½"
BRACKETS
4½"
¾" PLYWOOD
7"
TOP VIEW
¾"
2½"
1½" HOLE
⅛" STRAP IRON
⅜" HOLE
2"
2"
2¼"
2"
2¼"
BRACKET DETAILS
DRILL CARRIAGE
℄ OF DRILL
⅜" x 4" CARRIAGE BOLT
IRON LOCKS
SLEEVE ⅜" I.D. TUBING
CTSK.
COUNTERSINK LOWER NUT
C-CLAMP
CUT OFF HEAD
POSITION OF CARRIER TABLE



Drill is held by iron brackets on top of drill carriage. A setscrew at rear of drill clamps drill firmly when wing nut is tightened.



Drill works through slot in fence. In this photo work is held back from fence to show drill action. Ordinarily work is pressed against fence.

pulley shafts underneath to adjust the table's height and level it. When all is set, trim the excess off the pulley shafts on top and file them down flush with the table top.

Drill carriage. This, too, is made of ¾″ plywood. Bore ⅜″ holes in it for the vertical guides that hold the carriage true. The guides are made by cutting the heads off ⅜″ carriage bolts. The bolts are held by nuts above and below the carriage. Rub the bolts smooth with steel wool and oil them.

Drill brackets. These are shaped cold in a vise. The 1⅛″ hole in the front bracket will take the chuck shoulder of most ¼″ drills, but measure the shoulder on your particular drill. If your drill is larger, perhaps with a ½″ chuck, you will have to change the carriage and bracket dimensions to fit it. The carriage table is large enough to handle bigger drills than the one shown in the photos.

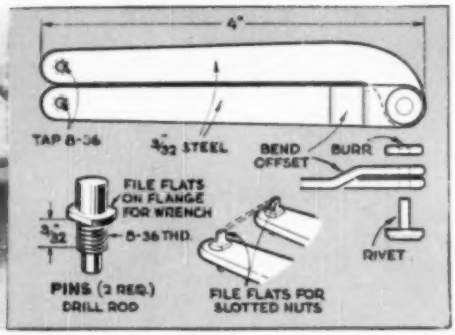
The rear bracket has a ⅜″ hole drilled in it. The center must align exactly with the center of the front-bracket hole. The small hole receives a ⅜″ machine screw with head cut off, filed to a taper at one end and square at the other. Drill the square end to take a brass or steel pin. A hexagonal nut on the inside of the bracket and a wing nut and washer on the outside permit tightening the screw securely against the back of the drill. Attach the brackets to the carriage 6″ apart (for ¼″ drill) and exactly on the centerline with flathead screws.

Guide sleeves. Now remove the guide bolts from the carriage and also remove the carriage table from the stand. Clamp the two together in correct respective positions and drill through the guide holes and table. Enlarge the holes in the table to take the guide sleeves of ⅜″ i.d. tubing. The sleeves must be a driving fit in the holes. This part of the drilling is best done on a drill press to insure plumb holes. Drill a 1″ hole through the carriage table, centered between the four guide holes.

Up and down adjustment. The raising and lowering mechanism consists of a 4″ C clamp cut off about 2½″ above the bottom of the bracket. Two-inch angle irons are bolted to the sides of the clamp bracket and in turn bolted to the underside of the carriage table so the clamp screw will turn up through the 1″ center hole. This permits about a 2″ up or down adjustment of the drill carriage. The head of the clamp sets in a slightly countersunk hole in the bottom of the carriage. The pivoting flat iron pieces attached with roundhead screws lock it in position.

Final step is to add the spring beneath the worktable. An ordinary screen-door spring cut down to proper length is fine for the purpose. After you have assembled your doweling machine, work the carriage up and down a few times, dropping oil on the guides, until it operates smoothly.

Place the drill in the brackets and clamp it in position with the setscrew. If all is square and true, a test drilling will show the dowel holes right on the button and straight into the work. END



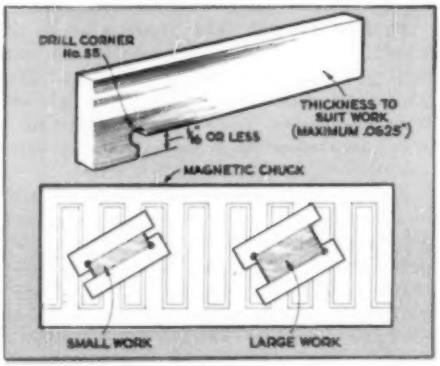
Spanner Is Adjustable. This tool will fit most of the round nuts used in instrument and optical work. It can be set instantly to suit the variously spaced holes or slots in these nuts.

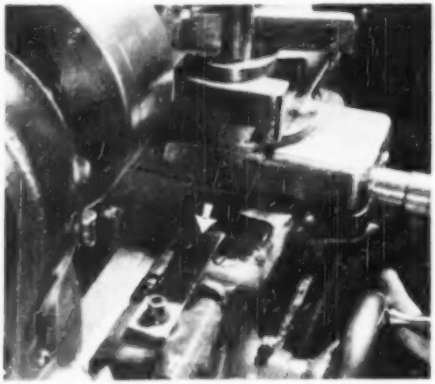
Make the legs of a good grade of steel, bending an offset in one to bring them parallel, and join with a friction-tight rivet. Tap the other end of both legs to receive the double-ended pins.

Turn these from drill rod, making the two ends on each whatever sizes will best accommodate the range of nuts with which you work. File the flanges flat on two sides so that you can tighten the pins with a small wrench. To fit slotted nuts, turn the pins into place, and file flats in line on the big ends as in the drawing. Harden the pins and temper to deep straw.—*Floyd McGuckin, Ridgewood, N. J.*

Stops for Grinding. It's often necessary to surface-grind thin pieces—.0625" thick or less—after they've been hardened. Heat treatment ordinarily warps them enough to lessen their holding area on a magnetic chuck. The usual dodge is to group four stops around such a piece to keep it from shifting.

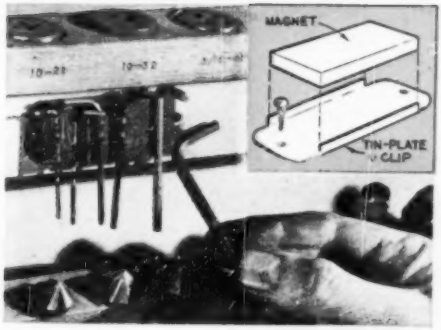
I find stepped stops handier because you need only two of them to hold small or large pieces. To make them, drill a small hole at the corners as shown, and grind the step to a depth of 1/16" or less. This is enough to hold even work that is severely warped. —*Karl Riebl, Woodhaven, N. Y.*





End-of-Cut Indicator. You can't use the carriage stop for turning to a shoulder with the power feed. But this visual indicator will help you stop each cut at the right time more accurately than watching the tool bit come against the shoulder.

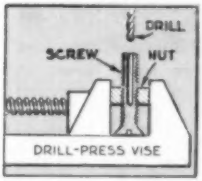
The indicator is easily made by clamping a piece of thin flat stock under the carriage-stop bolt. Take a first cut, stop the lathe, and set the indicator so that a line scribed on it coincides with one on the saddle (arrow). (Prussian blue makes the lines easier to see.) Thereafter, watch the lines, not the bit. Disengage the half nuts the instant the lines coincide.—*Joseph Tracy, Manhattan, N. Y.*



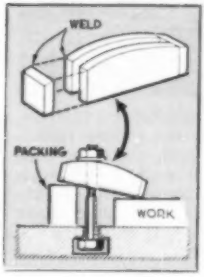
Magnetic Wrench Holder. Allen wrenches are among the hardest tools to keep handy, especially small ones. In one shop they're simply hung on a permanent magnet. The magnet, in this case a rectangular piece of Alnico ¾" thick, is held in a clip bent from tin-can stock.

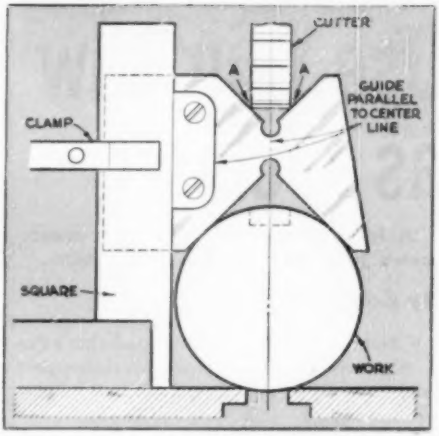
The wrenches become magnetized, but this is usually no drawback and may even be an advantage when a screw must be inserted downward in an out-of-reach spot.—*Walter E. Burton, Akron, Ohio.*

Drilling Hole in Bolt. When it's necessary to drill a hole lengthwise in a small bolt, just run a nut part way on the thread and clamp the nut in a drill-press vise. As soon as the drill bites, it will turn the bolt out until the head bottoms, providing a firm support for the operation.



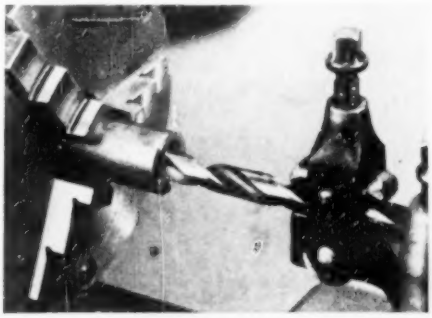
Self-Adjusting Hold-Downs. Unless clamps are blocked up to the same height as the work, the latter tends to shift and clamping bolts are bent. A set of these curved hold-downs, which can be made in any convenient size, will hold work securely even when packing of the correct size isn't on hand. They can be milled from solid stock or, if welding equipment is available, built up by adding end-pieces to two members shaped to a radius as shown at the left.—*Federico Strasser, Santiago, Chile.*





Tool Aligns Keyway Cutter. This accessory speeds up the chore of centering keyway cutters on round work. You can cut it out of ⅜" flat steel. Carefully file or mill the two 90° notches on a common center line, and mount a guide plate parallel to them by means of flathead bolts in tapped holes. Harden the tool if possible.

To use it, place the larger notch over the work and bring a square up against the guide. With the square resting firmly on the table and the guide plate against the blade, clamp the aligning tool as shown. Align the cutter in the upper notch to make contact at points A-A. It is then centered.—*Jesse R. Lucas, Michigan City, Ind.*



Twist Drill as Boring Tool. In an emergency, you can use a good-sized twist drill for boring in the lathe. Clamp it in an ordinary boring-bar holder so that one lip meets the work at a cutting angle at lathe-center height. Broken bits can be ground square across the business end for boring to a square shoulder.

Use Your Saw as a Jointer

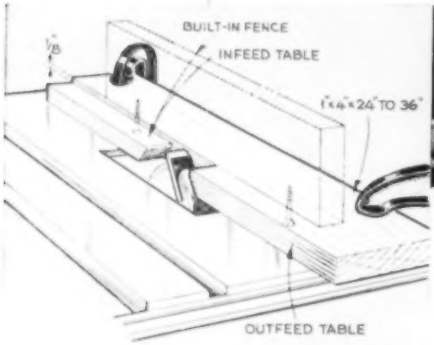
A molding head and homemade accessories give you another power tool.

By Edwin M. Love

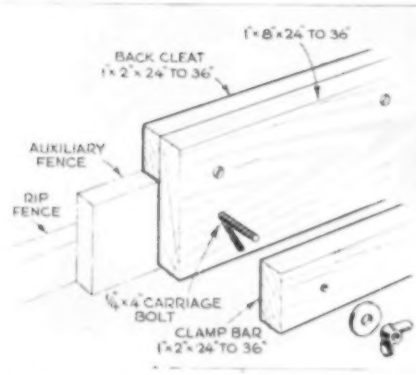
IF YOU have a circular saw—and that's the first major power tool most workshoppers buy—you need not do without a jointer another day.

You can get a molding head—which costs *way* less—and make yourself the wooden jointing accessories shown here. Then watch the chips fly as you turn out true edges, perfect butt joints, and other woodworking operations at machine-tool speeds.

Molding heads are fitted with removable cutters that are locked in the head by screws. Clean sawdust out of slots and lock the blades tightly whenever you reset them.

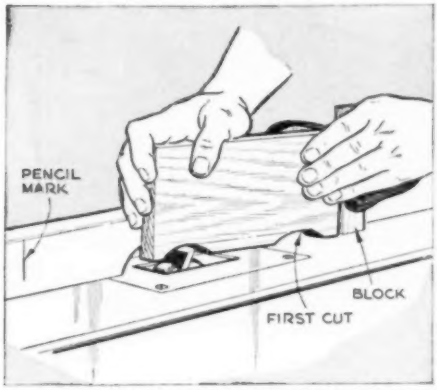


Jointer table is duplicated by setup shown in sketch (left) and photo (above). Note that infeed table is rabbeted so it's ⅛" lower than outfeed table. With the molding head set to make a ⅛" cut, the jointed part of the work will be supported by the outfeed table. If you don't have this difference in height, the jointed part of the work will rock down to the table and you won't get a true cut.

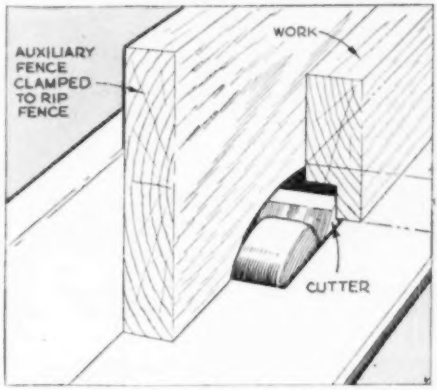


Carriage (above and left) is alternate method. It does the same thing as the jointer table—supports the part of the work that has been jointed. As you can see in the photo, the back cleat rides along the rip fence. The work—held by the clamp bar—is carried along over the cutters independently of the table. The whole assembly must be pressed firmly against the rip fence to guide it.

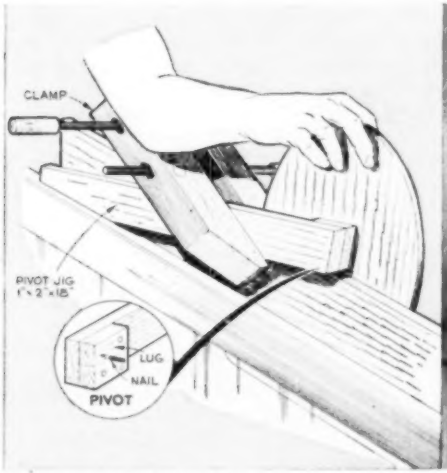
Quarter rounds or other moldings—depending on the shape of the cutters you have locked in the molding head—can be made with this setup (right). The wooden spring clamped to the fence, made by a series of parallel saw cuts, holds the work down against the pressure of the cutters. The spring should be long enough to bridge the slot in the table insert.



Recessing with the molding head is shown in the sketch above. Align the rip fence with the cutters. Clamp a block to the fence to mark start of cut and to keep the cutters from throwing the work. A pencil mark on the fence indicates the end of the cut. Make the first cut as shown. Then turn the work end for end and make the other cut to complete the recess.



Rabbeting with the molding head. Clamp the auxiliary fence over the cutters with the correct amount of blade exposed at the side. Adjust molding head for depth of cut and pass the work over cutters. You can form a rabbet that is wider than the cutters by making successive passes with fence shifted to a new position for each pass.



Pivot jig pictured above lets you joint or shape the edges of disks. A block the same thickness as the fence is necessary because the arm of the pivot jig is clamped to the rear of the fence. It isn't necessary to bandsaw the work to disk shape; just cut it roughly octagonal. The cutters will take off the corners. Drill a hole in the center of the work and slip the work over the pivot. Then revolve the work over the cutters. The guide, clamped to the table as shown in the photo, holds the disk against the fence as you revolve the disk.

CRAFTSMEN AT WORK

Some of the sinuous coils of pipe in this homemade radiant-heating system are shown at left. Alcide Lanoue, the builder, thinks any average handy man could duplicate the job.

Builds Own Heating Plant

ALCIDE LANOUE wanted radiant heating in the home he was building at Massena, N.Y., near the Canadian border. But he couldn't find a contractor in his locality to install it. So he did the job himself, although he is not a professional builder.

Guided by a handbook on radiant heating, he laid down 4" of crushed stone on a well-tamped fill. On top of this he laid a subbase of load-bearing hollow tile. A layer of heavy asphalt roofing paper was placed on top of the tile as a moisture barrier. Road mesh reinforcing wire was put on top of the paper. Then wrought-iron pipes were laid on the wire and fastened to it. Finally, a 4" slab of concrete was poured over the pipes.

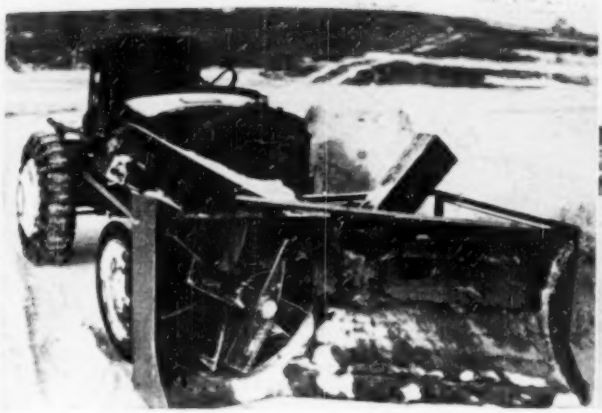
Centralized valve control for the entire radiant-heating system is shown above. Pipes embedded in concrete-slab floor carry hot water to provide uniform heat throughout house.

Lanoue hired a welder to join the pipes into a closed system. Bends were made with a hand-operated hydraulic bender. The welded joints were tested by hammering, and pressure was maintained for several days to make sure there were no leaks.

Pipe lines between floor coils and boiler were made of 110′ of 2" pipe. The sinuous floor coils were 1" pipe laid 12" apart and cut into the 2" lines at convenient points. Each room has a lead going into a header. The headers, made of 2" pipe with 1" nipples welded into them, are equipped with a shut-off valve for flow control and a globe valve for each coil. Slightly more than 1,000′ of wrought-iron pipe were used for 1,140 square feet of floor area.

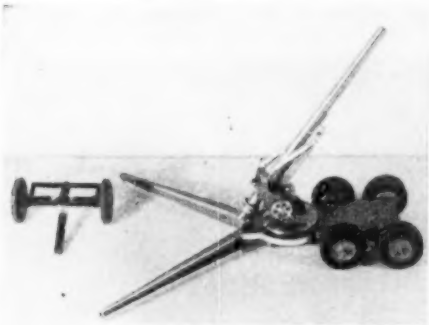
Including the oil burner, this system cost less than a professionally installed hot-water heating system.

Lanoue is an inspection foreman in a factory and now, after living in his new home for more than a year, says his homemade system works perfectly. It has kept his home comfortable in even the coldest weather. And it's economical, too. He has needed only about two-thirds as much fuel as was consumed in each of two nearby homes about the same size that have other heating systems. Lanoue's home is insulated in the same way as the other two houses.

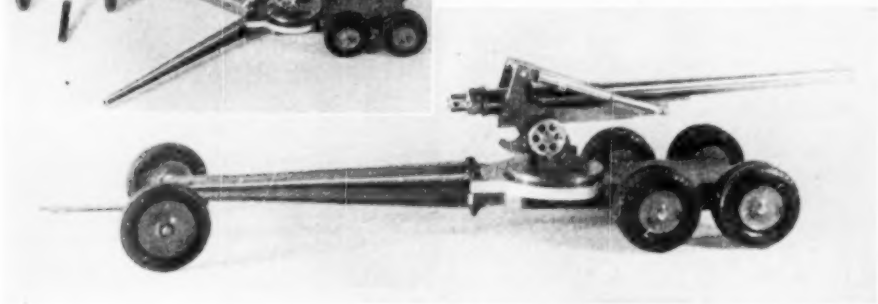


He Wanted Out. Orville Sorum, western Minnesota farmer, tired of blocked roadways from heavy wind-blown snows, worked out the small rotary plow above. More efficient than the usual small plows used by many farmers, it blows snow 75 to 100 feet away from the road. Sorum converted an old Dodge into a tractor, made blades for a blower, and used a Ford engine to power the blower.

Toy Is "Life Saver." The little firemen at right not only catch the victim in their life net, but toss him up again when a pull cord is released. Four little springs fastened to the base of each fireman and to the underside of the "cobbled street," increase or decrease in tension on the net as the cord is pulled or slackened. The four firemen and the victim are jigsawed from ½" pine, and realistically painted. The toy was designed by James O'Hara, of New York.



Long Tom Shoots Shell. This miniature 155 mm. gun, built by Alfred J. Brosseau, of Cambridge, Mass., actually fires a homemade shell, leaving a trail of smoke. The gun is equipped with a recoil mechanism, counterbalanced barrel, breech block, and electrical firing mechanism. Two handwheels control azimuth and elevation.



Cutting ease (right). One finger instead of both hands pushes 2" board through the blade.

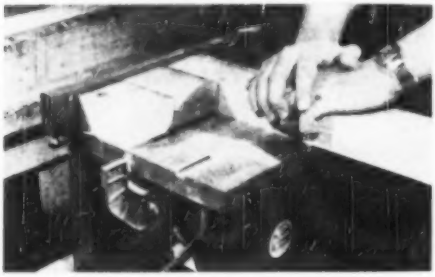
New 8-Tooth Blade Cuts Smoother, Safer

HERE'S something new in circular-saw blades—an eight-tooth blade that eliminates kickbacks, cuts smoother, requires about 30 percent less power, makes less noise than a conventional blade, and doesn't need sharpening as often.

The German-made, carbide-tipped blade was used in a woodworking plant for 2,037 hours without sharpening. During this time, it was used to cut oak and hard maple, producing cuts suitable for edge gluing.

Safety also is a big feature of the new blade, marketed in this country by P.T.I. Inc., New York City. According to the company, if the operator's hand comes in contact with the blade, the teeth will not grab the hand and pull it into the blade. The company bases this assertion on laboratory tests.

A unit that fits most bench grinders is available for sharpening the blade.



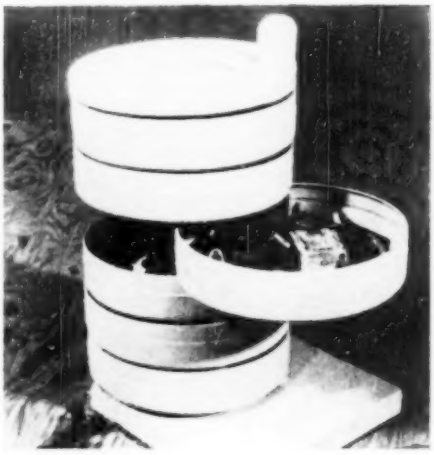
It works here (left) but it's bad practice with conventional blades. Ordinarily, the cut-off blocks would jam. They don't with this blade.

Here's the new eight-tooth blade (right). Instead of sawdust, it makes chips, leaving a cut smooth enough to glue without sanding.

Small-Parts Trays Swing Out

HERE'S a tidy rack for any man's shop. It is made of the containers in which large rolls of cellulose tape are sold. Six bottoms and one top are used.

Cut a wooden base and glue into it a ¾" dowel. Drill a ¾" hole through each box a little more than ¾" from the edge so that the side of the can will ride against the spacer. Spacers to separate the trays are cut from ¾" dowel or broomstick about ⅝" longer than the height of the trays and drilled ¾" for the dowel spindle. Make the top spacer longer to accommodate the cover. Two washers under the bottom tin permit it to swing free of the base. Blind-drill a short length of ¾" dowel to make a spindle cap and glue it on.—*Will Thomas, Buffalo, N. Y.*



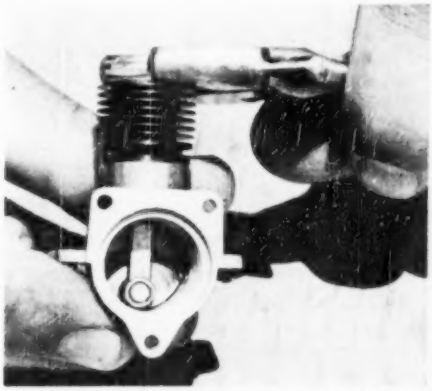
Anyone Can Build New Model Engine

EVEN if you know nothing about engines, you can now build a working model. It's done with a kit of 27 precision parts. When you're through, you have a .049-cu.-in., two-cycle, glow-plug engine that easily turns up to more than 10,000 r.p.m.

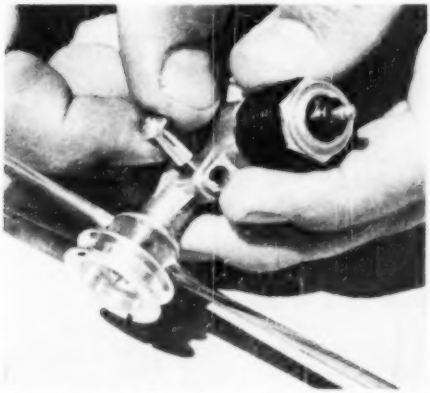
The manufacturer claims you can assemble it in 15 minutes, but that's for duffers. It's possible to have the engine ready to run in five minutes. Besides engine parts, the kit contains an engine-mount fuel tank, a 5½" plastic model-airplane prop, a spin starter. Herkimer Tool and Model Works, Herkimer, N. Y., prices the kit at $4.75.

A model boat or car or plane can be run with the engine shown being assembled below.

Here are the parts you buy in kit—as well as typical tools required to put them together.



Assembly is well under way here. Crankshaft must be down as you tighten head and cylinder.



Threading needle valve on its tube completes the job. Finished engine weighs only 1½ ounces.

A test block like this is suggested for breaking the engine in. It's made from a two-by-four.

No Brush Marks or Bristles

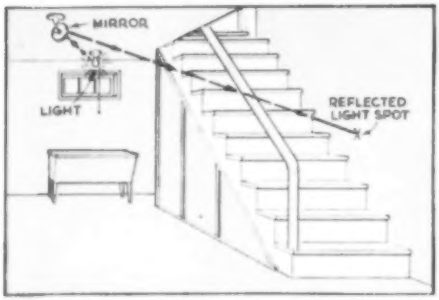
THE woman painting the chair at left is using a new two-bit applicator instead of a 3" paintbrush. It eliminates the bristle-shedding of cheap brushes and the work of cleaning a brush for storage. The price is so low that it may be thrown away when the job is done. According to the maker, Parfait, Inc., Chicago, the applicator leaves no brush marks. The gadget consists of cotton cushioning over a plastic core and is covered with cotton fabric.

Reel Serves as Drill Holder

YOU can build a simple rack for your drills—and it won't cost you a penny. Get a metal wire reel from your electrical dealer's scrap box and drill holes in one flange for the various size drills. A piece of felt weather stripping around the bottom flange keeps the drills from slipping out if the reel is moved. Nail a stepped wooden block to the bottom flange for small drills to rest on. —*H. Leeper, Canton, Ohio.*

Mirror Spots Forgotten Light

MAYBE this gimmick of mine will save you as many steps as it does me. One of the lights in our cellar is not controlled by the switch at the head of the stairs. I had a habit of getting all the way up the steps before I remembered I had not turned out the light. Now a small mirror reminds me. I fastened the mirror to a joist so it reflects a spot of light on the stairs. If I forget to turn out the light, the spot of light reminds me before I even start up the stairs.—*J. D. Porter, Schenectady, N. Y.*



Scratch Stock Improvised

WHEN old-time craftsmen made a piece of molding, they used a scratch stock—a handle that held a cutter. This was pulled along the edge of the work. The cutters had various contours to turn out moldings of different shapes.

You can make a similar tool that's especially handy in duplicating moldings. File one end of a flat piece of steel to the desired contour and mount this cutter in place of a spokeshave blade. Usually the blade can be fastened to the spokeshave handle by drilling a hole for the screw that held the regular blade. When using the tool, scrape with the grain and take light cuts.—*Walter E. Burton, Akron, Ohio.*

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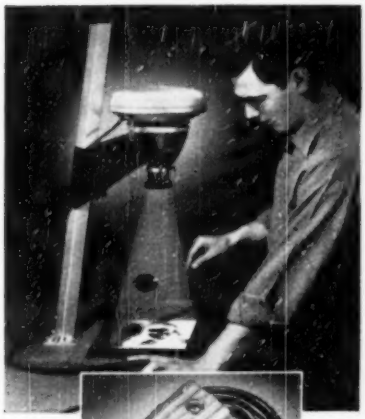

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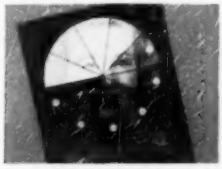


Kodak Projection Print Scale—10 sectors of varying density indicate different printing time. $1.34.

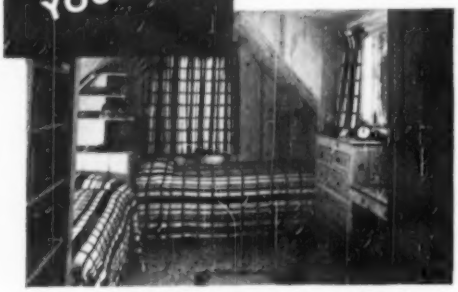
Prices are subject to change without notice and include Federal Tax where applicable

Kodak

Your Kodak dealer will be glad to show you this enlarging equipment... EASTMAN KODAK COMPANY, ROCHESTER 4, N. Y.

FINISH THAT ATTIC YOURSELF!

with cheerful WESTERN PINES*



ISN'T it about time you did something to that unfinished attic? Sure you can do it—with a little planning and ingenuity, and the help of the popular Western Pines*. Think what it will mean to have that idle space in use—an extra guest room, perhaps, or a bunk bedroom in real western style for your young buckaroos . . . a sewing-room for Sis, or a combined study and platter paradise for the teen-agers.

It's no trick at all to finish off an attic—or basement, for that matter—with paneling and built-ins of easy-to-work, decorative Western Pines*. These soft-textured, fine-grained woods are practical and enduring; they respond to a variety of finishes and endow any room with their own friendly, cheerful charm.

FREE Idea Packet No. 313-L contains scores of helpful how-to-do-it suggestions for reclaiming idle attics or basements for extra living space. Included also is a copy of the colorful booklet, "Enchanting Homes of Western Pines," with 71 illustrations!

WRITE TODAY to WESTERN PINE ASSOCIATION
Dept. 313-L, Yeon Bldg.
Portland 4, Oregon

These are the Western Pines
*IDAHO WHITE PINE
*PONDEROSA PINE
*SUGAR PINE

Gus Saves a Birthday Party

[*Continued from page 192*]

wasn't always so sure there weren't some mean little men who spent their mysterious lives plaguing garagemen.

About a half hour later, the sound of a car rolling up to the repair-shop door brought Gus' head out from under the open hood of the car he was working on. It was the Dorman's coupe again.

"Now I'm hexed too," Myrtle Dorman exclaimed as she slid out from behind the wheel. "That silly little gauge was working perfectly when I left here for the station, but now it's not. It's acting just like Ted said."

"It's those pixies," Gus reminded her with a grin. "They probably heard you talking about Ted and decided to play a few tricks on you for a change. Well, at least everyone agrees that something's wrong, so maybe now we can spend a little time and go to work."

"Please do," Mrs. Dorman pleaded, "so the Dorman household can get back to normal and enjoy the birthday party the youngsters have planned for Ted tomorrow. Meanwhile I'll go on down to town on foot and get some of my ordering done."

When Mrs. Dorman had departed, Gus wheeled the car into the shop. He rechecked the gauge, the connections to the gauge, and the wire lead. Since he couldn't find anything wrong at those points, he decided the next step was to check the tank unit.

As he walked around to the rear of the car he saw Ted's crated saw protruding from the half-open trunk.

"Hey, Stan," he called to his helper, who, at the moment, was busy at the greasing rack. "How about giving me a hand?"

Gus Shares His Troubles

"What's the latest headache, boss?" Stan Hicks asked as he walked back to the car.

"The kind that drives mechanics nuts," Gus complained. "It's the gas gauge—sometimes it works and sometimes it don't. Right now it's in a nonworking mood. Besides that, it's become a major issue in the Dorman family's affairs."

Together they lifted the crate out of the trunk and placed it on the floor alongside the repair bench.

Gus was just about to begin prying the inspection plate loose from the trunk floor to get at the tank unit when Stan, who had walked around to the front of the car,

[*Continued on page 244*]

Maybe you don't need expensive anti-freeze

***Results of Du Pont tests show most motorists can get complete winter protection from $1.25-a-gallon* "ZERONE"**

This may surprise you—but here's what exhaustive winter road and laboratory tests made by Du Pont now prove about anti-freeze performance.

Du Pont "Zerone"*—at only $1.25 per gallon—will provide efficient, proper protection against cold weather, rust and corrosion for four out of five cars on the road today. These are the cars with low-opening thermostats, operating at normal altitudes, and requiring protection no lower than −30 F.

If you've been overspending on anti-freeze in the past, you can save money with Du Pont "Zerone."

- **With "Zerone," there is no evaporation problem—it needs only an occasional check-up.**
- **You buy less—"Zerone" is so efficient that 3 quarts do the work of 4 quarts of most other kinds of anti-freeze.**
- **"Zerone" has a chemical rust-inhibitor that helps keep a clean cooling system clean—won't attack rubber; and because it stays in solution, it can't clog cooling systems.**

This winter, save good money on anti-freeze. Ask your service station attendant if you, too, can't use inexpensive Du Pont "Zerone" in your cooling system.

*REG. U. S. PAT. OFF.

Listen to "Cavalcade of America" Tuesday Nights, NBC Coast to Coast

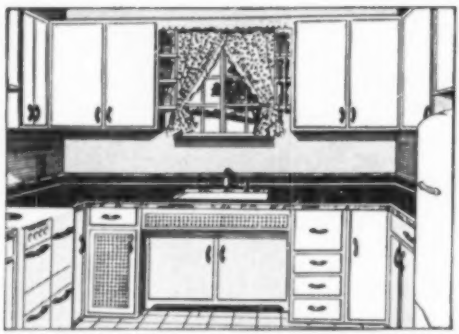
Cooling System Specialists

THE DEALER WHO DISPLAYS THIS EMBLEM offers you a special winter service. Make a date with him early for anti-freeze and for a thorough cooling system check-up before the anti-freeze rush jams his driveway.

DU PONT

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

More motorists use Du Pont "ZERONE" anti-freeze than any other brand



MAKE YOUR KITCHEN MODERN

. . . this low-cost easy way

. . . including today's new counter top

To help you modernize your kitchen the easiest possible way—and *save up to 75%*—we offer the famous Easi-Bild Build It Yourself* patterns for base and wall cabinets.

By this method, we help you discover the miracle counter top: Micarta . . . the plastic surface so smooth, so tough and lustrous, it resists any scratching, denting, or chipping—can't be stained or discolored by boiling fats, alcohol, fruit juices, greases or oil—so beautiful and colorful it's the choice of today's leading architects.

You can buy Micarta at your local lumber yard, already mounted on ¾" waterproof Weldwood plywood. Ask for Micarta *panels*. They can be sawed, trimmed, planed and drilled by ordinary hand tools.

DO IT YOURSELF...SAVE BIG MONEY

And, to take all the mystery out of building Base and Wall Cabinets for your kitchen, child's room, playroom or bedroom, send for the patterns below. With them you buy only the materials the patterns clearly specify—at your local lumber dealer. You cut each piece exactly as the easy-to-follow, step by step directions indicate, then fasten into the positions shown by the "easy-as-pie" assembly illustrations. No special tools or skill are required.

Over a million Easi-Bild Patterns have been sold because they make your project easy, inexpensive and professionally perfect. Buy them at your lumber or hardware dealer or order them in the coupon below.

*TRADE MARK, Easi-Bild Pattern Company

MICARTA is manufactured by WESTINGHOUSE and sold for decorative purposes only, by UNITED STATES PLYWOOD CORP.

Guaranteed by Good Housekeeping

UNITED STATES PLYWOOD CORPORATION
PATTERN DEPT. P.O. Box 215, Pleasantville, N. Y.

Enclosed is $_____ for items checked below.

- ☐ Send FREE sample of Micarta
- ☐ Kitchen Base and Wall Cabinet Patterns No. 201 at $1.00
- ☐ Service Counter Pattern No. 80 at 60c
- ☐ Easi-Bild Pattern Catalogue illustrating over 100 other "Build It Yourself" projects at 20c

Name _____

Address _____

City _____ State _____

PS-11-50

Gas Saves a Birthday Party

[Continued from page 242]

shouted, "Whaduya mean the gas gauge doesn't work? Shows better'n half full right now."

Gus shoved his screwdriver back into a coverall pocket and joined Stan. Sure enough, the gauge was past the half-way mark.

"You've smoked them out, Stan, . . . the pixies, I mean," Gus added with a smile. "I think you've hit on something. Let's have a look at that tank connection."

Together they worked on the inspection plate that was badly rusted in place.

A "Weighty" Problem Solved

"There's at least one-third of our trouble," Gus pointed out, poking the tip of his screwdriver at a well-worn rubber cap that originally was intended to insulate the electrical connection on top of the fuel tank from contact with the body of the car.

"What's the other two-thirds?" put in Stan.

"Two things," said Gus. "First of all, any heavy object, like that crate or Ted's sample bags. Second, this loose metal plate in the floor of the trunk." He pointed to the floor's center section.

As Gus talked, Stan could see that the weld at the rear of the metal sheet forming a part of the trunk floor had broken loose. Any heavy weight placed on it would force it down until it made contact with the bare terminal on the top of the gas tank, shorting out the line and the gauge.

It took Gus about 35 minutes to drill holes and bolt the loose section in place and to tape up the terminal on the top of the tank.

After he and Stan lifted the crated power saw back into the trunk, Gus turned to Stan and said, "I'm going to lunch. When Mrs. Dorman comes to pick up the car, tell her to have a nice birthday party for Ted tomorrow. And tell her I'll expect Ted to have a piece of his birthday cake for me when he stops in for gas Monday morning." END

Leaks Waste Lots of Gasoline

AFTER several thousand miles of service, your car is likely to develop one or more leaks somewhere in the fuel system. You can lose considerable gasoline in this way. You can avoid this trouble by making a practice of regularly inspecting the fuel line, gasoline tank, and the various other connections.

American Flyer

3/16" SCALE AND HO GAUGE

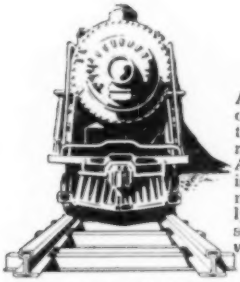
WORLD'S MOST REALISTIC TRAINS

REAL SMOKE AND "CHOO-CHOO" SOUNDS

No. 4904T Pacific 3-car Freight—The faster your train goes, the more smoke it puffs, the louder are the "choo-choo" sounds. Powered by famous Gilbert motor. Complete with real, 2-rail track, making 140" oval, 3 realistic cars, transformer, $29.95. Denver and west, $31.50.

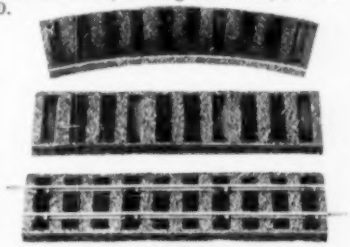
SUPERB NEW SANTA FE PASSENGER

No. 5008 Santa Fe 3-car Passenger—Built-in Electronic Horn. Authentic scale model. Over 5 feet long. 3 ultra modern aluminum cars, including Vista Dome Pullman. Locomotive powered by *two* Gilbert motors. Real 2-rail track, making 160" oval, $62.50. Denver and west, $65.00.



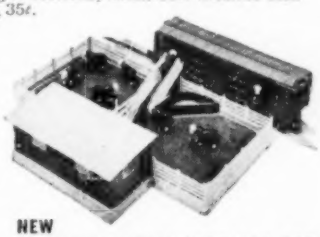
REAL 2-RAIL TRACK

American Flyer track looks like the track of a real railroad. There's no old-fashioned third rail in the middle. For further realism, track can be mounted in new American Flyer Rubber Roadbed, finished to resemble real ballast. Reduces noise. Non-slip back holds tracks securely in place without tacks. Curved or straight sections, each, 30¢. Denver and west, 35¢.



TALKING RAILROAD STATION

Produces voice of train announcer and other true-to-life sounds of busy station. Stops train by remote control—starts it automatically. $16.95. Denver and west, $17.80.



NEW OPERATING STOCK YARD AND CAR

An exclusive American Flyer sensation! Watch the steers mill around when you press remote control button. See them climb up ramp and enter car. Most amazing of all, you can make them file, one by one, out of car and down to stock pen again $14.95. Denver and west, $15.70

GET THIS GIANT TRAIN CATALOG

Cost over $125,000.00 to produce! 56 big full-color pages.

Illustrates and describes all American Flyer train sets—locos—cars and spectacular equipment. Free at stores selling American Flyer or send 10¢.

Gilbert Hall of Science,
153 Erector Sq., New Haven, Conn.

Rush Giant Train Catalog.
I enclose 10¢.

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This offer good only in U.S.A.

See the ZEPHYR PORTABLE ELECTRIC ¼-INCH DRILL

TWO MODELS
No. 1950-H (with precision hand-operated chuck) ONLY $17.95
No. 1950-G (with precision gear chuck) ONLY $19.95

- Tops in Quality
- Right in Price
- Built to Last

Want power and speed, easy action, and durability in a drill that does just about everything? Then get the feel of this streamlined Zephyr! Weighs only 3 lbs. 2 oz. but it's husky for work; engineered for accuracy and long tool life. Fan-cooled 110-120 volt motor delivers 1000 rpm. with full load; 1600 rpm. with no load. Cutler-Hammer trigger switch. Housing, handle, gear case of die-cast aluminum. U. L. listed. Attachments (available at extra cost) make it a work saver on scores of jobs—sanding, polishing, buffing, grinding, sharpening.

Portable Electric Saw

ZEPHYR MODEL 625
$39.95 COMPLETE

The portable saw with all the features! Cuts to 2⅞". Adjusts 90° to 45°. Balanced for easy, one-hand operation. AC-DC motor 115-120 volts.

SEE THESE TOOLS AT YOUR DEALER OR WRITE US DIRECT
Prices slightly higher in Canada

Send for Free Booklet!

Get this 16-page illustrated catalog with full information on all Portable Drills, Saws, Spraymaster, Spin-a-Brush, and other attachments.

PET PORTABLE ELECTRIC TOOLS, INC.

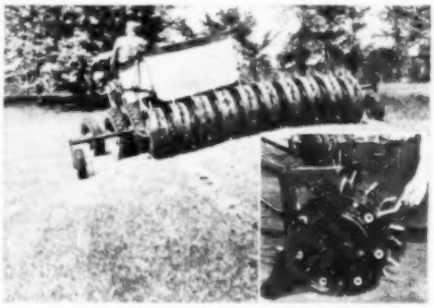
326 West 83rd Street, Chicago 20, Illinois
In Canada: 369 Danforth Rd., Toronto 13, Ont.

Mechanics of Farming

By Ladd Haystead

■ Panic buying of farm machines is worrying everyone in agriculture from manufacturers through dealers and down to those farmers who kept their heads at first when others went scare-crazy. In early summer dealers were worried over logy inventories. Then the Korean war hit. At first little happened; but as housewives got frightened, farmers began to remember Last Time. Soon reports came in that some dealers were cleaned out, then that farmers were buying machines unsuitable for their size or type of operation. People worried about impending controls--then went out to buy, which of course was the very thing to bring controls on. Of the 100-million-ton steel capacity, only 3 million is needed for farm machines to maintain our already well-equipped agriculture. We are immeasurably better off than at Pearl Harbor.

■ "Aeration is the most important development in turf management since the power mower," says Dr. Fred V. Grau, of the Dept. of Agriculture. If so, Soilaire, "the mechanical earthworm" (see cut), is important news. When a grassland becomes sod-bound, water doesn't penetrate, erosion starts on slopes, while water-



logging occurs on low areas. When the hollow tine of the Soilaire is driven into the ground, it removes a core of soil to provide aeration and moisture retention. The tines protrude 3¼ inches through the slotted rim, and are full tapered so that

WINTER AHEAD
INSTALL NEW
CHAMPION
SPARK PLUGS

New, *High-Speed* ELECTRIC PLANE

Weighs 8 lbs.

WORKS AS A JOINTER

FITS DOORS AND SASHES

SHAPES EDGES, MOULDING

A Work-Horse For Any Home Shop *Only* $65.00

Try it. You'll agree that as a labor-saving device it's more than the equal of any tool in your shop. It does jobs your other tools cannot do, in real professional manner. And the hardened, razor-sharp spiral cutter is F-A-S-T—20,000 rpm. Zips off the shavings, leaving a straight, smooth, non-fuzzy surface with or against the grain, with no bumps, no gouges. Enables you to do perfect surfacing, fit doors, windows, drawers, screens, storm sash, trim of every kind. Ideal for hobby projects—built-in furniture, cabinets, bookcases, benches.

Special Jointer-Shaper Cutters

Yes, you can even use this plane as a bench jointer-shaper, or as a moulding plane. Spiral cutter for jointing work; variety of shaper cutters for decorative edging, grooving and channeling. Optional Sharpener (extra) puts keen edge on plane cutter in 3 minutes.

***Same Motor** Powers 2 Other Guild Tools:* Motor of your Guild Power Plane is interchangeable with the versatile new Guild Router—one of the most valuable tools for advanced home-craft projects; also with the Guild Shaper, adapted from the Router. Router base only (using Plane motor), $7.50. Router complete, $47.50. Shaper Table only, $24.00; complete with Router, $71.50.

At your dealer's—or mail coupon.

Send me full information about the Guild Power Plane and attachments . . . Also name of nearest Guild Tool dealer.

Name.....

Street.....

City..... State .....

PORTER-CABLE MACHINE COMPANY
2311 N. Salina St. Syracuse 8, N. Y.

they clean themselves. The machine is produced by Soilaire, Minneapolis.

■ Maleic hydrazide, a new chemical, can delay the growth of plants for days or weeks. This chemical could probably have prevented millions of dollars of loss to peach growers in Georgia and South Carolina last year by holding ripening back until frost danger was gone. The substance is produced by the Naugatuck Chemical Division of U.S. Rubber.

■ Nerve gas--parathion--is a top insect killer, but it has also killed a dozen farm workers and chemical packers in the last two years. Men on the big spray rigs must wear a mask or die. Even more toxic are insecticides TEPP and HETP, according to the Food and Drug Administration.

■ A light frame, plastic covering, and a zipper fastening are combined in a new bumblebee cage designed to get higher pollination from the bees on experimental crops where wider, quicker testing of new strains is desirable. The cage was developed by the Utah Agricultural Experimental Station at Logan. Almost 100 percent "tripping" of blossoms is claimed.

■ A new baled-hay loader that enables a driver and one man to load a truck faster than four men could do it previously is announced by the Montana Agricultural Experiment Station at Bozeman. The loader can be home built. The Station charges 80 cents for plans.

■ The Russians, who claim to have invented practically everything, claimed a few years ago that they were able to increase potato yields from 16.7 to 68 percent by treating the seeds with ultrasonic vibrations. Our Beltsville Station tried the process fruitlessly. But they used sound waves for a successful kill on the flying moth that lays corn borer eggs. Sound waves will also break up the fat globules in milk in a process similar to homogenization. Experiments now are under way to use radar on eggs in the hope that something more efficient, accurate, and economical can be found to replace candling.

THE NEW 1951 HARLEY-DAVIDSON HYDRA-GLIDE®

SLEEK, smooth and beautiful. And what a *performer*. Takes off like a scared rabbit. Snuggles to the road like a clinging vine. Breezes over hills like a bird. Whisks you over rough spots with cloud-like ease . . . brings you thrill after thrill as you take in exciting race meets, hillclimbs, gypsy tours, sightseeing runs and other exclusive motorcycling fun events. You've never really been places and seen things until you've ridden *this* dazzler! Every moment in the saddle is fascinating. Every trip brings new adventures and new companionships. See your dealer today. Mail the coupon now.

Send free copy of ENTHUSIAST Magazine filled with motorcycle action pictures and stories; also literature on new models.

HARLEY-DAVIDSON MOTOR CO., Dept. P5, Milwaukee 1, Wis.

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OPPORTUNITY: Valuable franchises available for full line of Big Twins and 125 Model. Write Today.

Sands Cleans **Smooths Polishes**

Designed for industry, for professional work, this light, beautifully balanced, *orbital-motion*, SpeedSander is rapidly becoming a standard home appliance. With its powerful electric motor and all-ball-bearing construction, anyone can easily re-surface and refinish furniture, woodwork, metal surfaces or walls. It will quickly remove old paint, stain, or enamel down to the bare wood or metal; will sandpaper to a "piano finish," remove rust and corrosion or "feather edge" a scraped fender. It will burnish pots and pans or with lambs wool bonnet, delicately polish fine furniture. It makes tedious, tiresome jobs fun—saves hands! In design, convenience and efficiency it is today's finest sander regardless of price. Ask your local dealer to demonstrate it.

Speed Way Speed Drills

Far advanced in design and construction these new SpeedDrills are lighter, handier, yet more powerful and faster-drilling than more costly old type drills. Drill steel, wood or concrete. Quality built for lifetime service, of die-cast aluminum with cast-in air cooling system and self-lubrication. Heavy cut-steel gears. Ball thrust bearings. Your Speed-Way Dealer will point out the many other superior features.

Kits Make Ideal Christmas Gifts

Any craftsman or "Mr. Fix-it" will be thrilled with a SpeedDrill Kit that drills, grinds, sands, buffs, polishes.

No. 79 Kit provides a No. 79 ⅛" capacity (in steel) SpeedDrill, a SpeedStand, wire brush, sanding discs and backer plate, cloth and lambs wool polishers, paint stirrer and 5 steel drills—31 pieces in all in fitted steel carrying case, complete **$29.95**

No. 200 Kit. (Not illustrated) Similar to No. 79 Kit but with No. 200 ¼" capacity (in steel) SpeedDrill and 28 accessories in fitted case, complete **$19.95**

GA Kit. 20,000 r.p.m. SpeedWay No. 129 Hand Grinder with 16 mounted cutters, brushes, and wheels, complete in leatherette case. **$13.95**

Bench SpeedGrinders—**$14.95 to $29.95**—Ask your dealer to show them to you.

Bench Speed-Grinders—

Speed Way MANUFACTURING CO.
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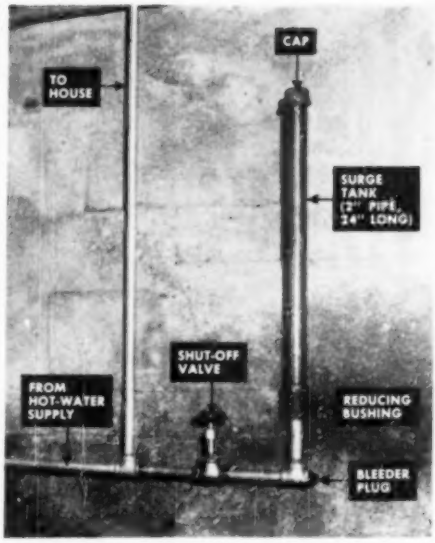


Tank Cushions Water Hammer

MANY dish washers and other automatic home appliances employ electric valves that turn water off very fast. Sudden valve closing, especially in high-pressure areas, produces a brief but severe strain on the rest of the water system.

To reduce the shock on my hot-water pipes, I made the air dome shown from a 24" length of 2" pipe, three tees, a shut-off valve, a bleeder plug, and pipe reducer. Back pressure caused by fast turn-off of appliances is now absorbed by air trapped in the 2" pipe. To keep the system from becoming waterlogged, I bleed the surge tank three or four times a year by closing the shut-off valve and opening the bleeder plug.—*E. C. Robare, North Adams, Mass.*

Re-Use Nail-Polish Bottles

DISCARDED nail-polish bottles make excellent containers for light lubricating oil for household use. The fine brush makes a good applicator. Clean both bottle and brush with polish remover or lacquer thinner before filling with oil.—*Kenneth Murray, Colon, Mich.*

Biggest Factory in the World

DISTANCES are so great that personnel use bicycles to make their rounds in the huge "K-25" gaseous-diffusion plant for separating uranium 235 at Oak Ridge, Tenn. It is probably the world's largest production unit under one roof.

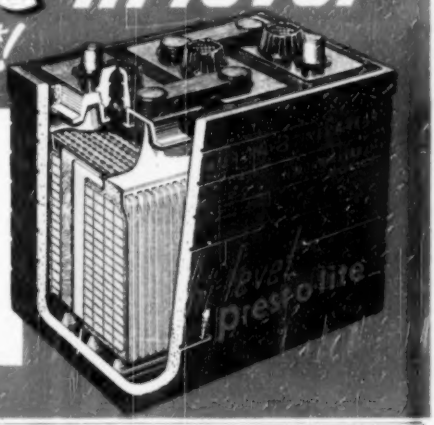
Hi-level needs water only 3 times a year!
in Normal Car Use

Prest-o-lite *hi-level*

70% longer average life!*

AVOID battery failures, get longer battery life, with the new Prest-O-Lite Hi-Level Battery that needs water only 3 times a year in normal car use. Helps prevent a major cause of battery failure. In addition, Hi-Level gives you Fibreglass mats to keep power-producing material in the plates for longer life. Make your next battery a Prest-O-Lite Hi-Level.

PREST-O-LITE BATTERY COMPANY, INC.
Toledo 1 Ohio



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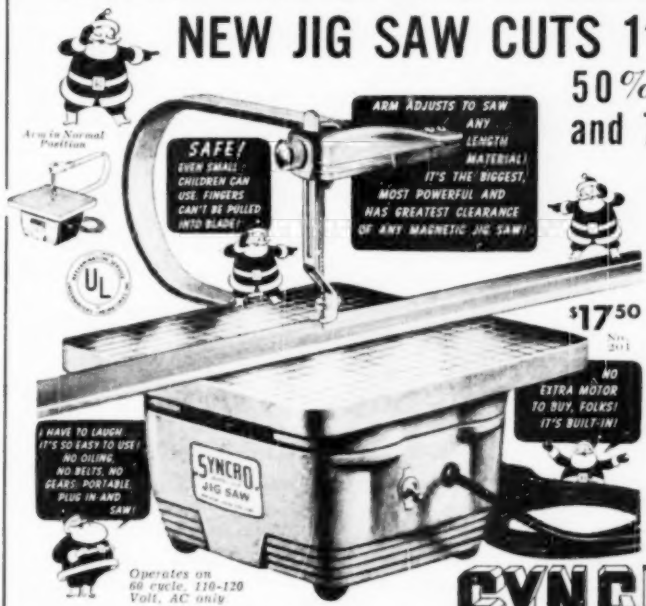
NEW JIG SAW CUTS 1" WOOD with 50% MORE POWER and 70% LESS NOISE!



SYNCRO POWER UNITS GUARANTEED AGAINST BURN-OUT ALL DURING YOUR OWNERSHIP or Replaced FREE!

Santa suggests the largest, most powerful, most versatile jig saw of its kind, yet *safe* for children—SYNCRO! The entire family will enjoy it. Now *70% quieter operation* with *50%* MORE POWER! Cuts *any* length 1" wood, thin metal, plastic. Precision-built to last a lifetime. Portable. Ideal for apartment use. Just plug in and saw. Not a "lumber" cutter, but for fine, delicate craftsmanship. TESTED and APPROVED BY UNDERWRITERS' LABORATORIES, INC. *and* Power Unit GUARANTEED *Against Burn-Out* BY SYNCRO all during your ownership! Buy with *confidence*. Sold only at the best dealers!

COMPLETE *with* BUILT-IN MOTOR, *$17.50. If Dealer hasn't it, send $17.50, we'll ship postpaid.*

SYNCRO QUALITY ELECTRIC TOOLS

SYNCRO CORP., Dept. G-110, Oxford, Mich., U.S.A.

YOU GET A COMPLETE POWER WORKSHOP PLUS EXCLUSIVE BONUS FEATURES WITH SHOPSMITH

It's *more* than five rugged power tools in one compact unit. SHOPSMITH is a complete power workshop; saw, disc sander, horizontal and vertical drill press, lathe—each with *exclusive bonus features* that make SHOPSMITH far and away your best power tool buy!

Imagine a saw that locks in a vertical position for cutting extra-large panels, for trimming doors, screens, storm sash! A disc sander that *feeds into* the work. A drill press that does a perfect doweling job *without jigs.* A lathe that lets you *face the work* while faceplate turning.

Imagine a sturdy, guaranteed-for-one-year, precision-built unit so ingeniously engineered that you can convert it from tool to tool *in less than 60 seconds.* So compact it fits any 2 x 5 foot space. So completely flexible you can do 116 wood, plastic and metal-working operations. So unlimited in capacity you can build a house with it.

But why *imagine?* See SHOPSMITH for yourself. Compare it feature-for-feature with any other power tool or combination of single-purpose tools. Then compare prices *complete!* At any Montgomery Ward, leading hardware or department store.

$169.50

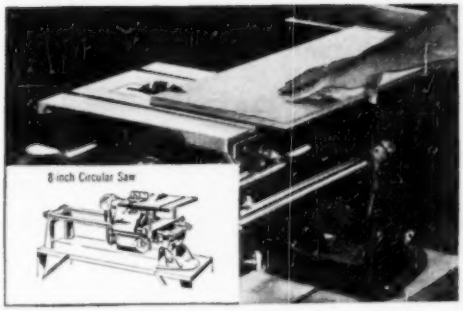
complete except for motor. With special, ½-hp., capacitor-type motor *(shown)*... **$199.50**

CONVENIENT TERMS

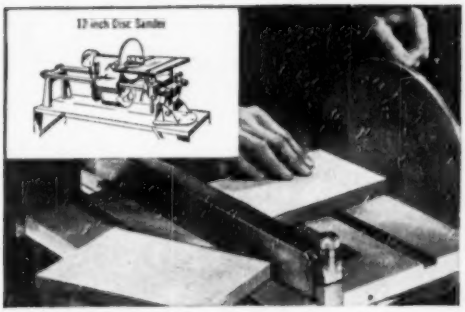
NEW RETRACTABLE CASTERS FOR SHOPSMITH

They save space, increase SHOPSMITH'S great flexibility

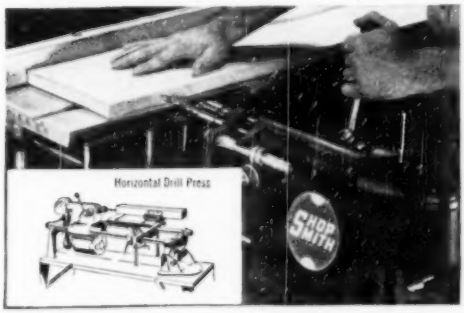
Now your SHOPSMITH can be completely mobile. Move it, roll it, lock it—on specially designed, three-stage, retractable casters. They're easily mounted on any wood or metal bench. Easy to set, too—each pair of wheels is operated by a unique foot lever. See your SHOPSMITH dealer. Price complete (4 wheels, 2 levers)..... **$11.95**



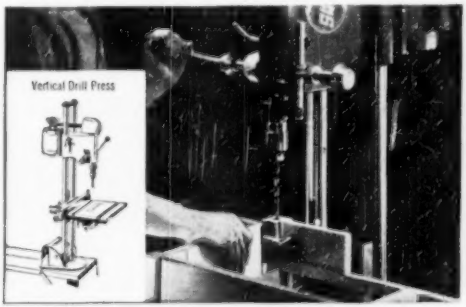
HAIRLINE SETTING. Unique micro-quill adjustment positions saw blade for extremely accurate width of cut. No more difficult fence settings. Saw has 48" fence-to-blade capacity, large tilting table, precision tooled miter gauge, self-aligning rip-fence, table raiser. 2¼" depth of cut.



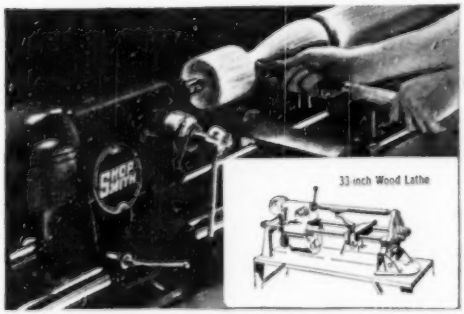
DUPLICATE SANDING. For making two or more pieces exactly the same length. Only SHOPSMITH has this feature plus 12" precision balanced disc, 14½" x 17" tilting table, both miter gauge and fence. Disc feeds into work for maximum speed, accuracy and safety. Stop-nuts set feed depth.



PERFECT DOWELED JOINTS. No jigs required. Just lay work flat on table, feed drill from side. Dowel holes match perfectly. Especially handy for drilling or mortising large, heavy work. Speeds range from 875 to 3500 rpm. 4" quill feed. Unlimited capacity. Adjustable depth scale.



LEFT-HANDED, TOO. Only drill press on the market with right- or left-hand feed lever. Drills to the center of 15" circle. Maximum clearance table to chuck of 27", floor to chuck, 55". Jacobs key chuck takes drills up to ½" diameter. 4" quill feed. Miter gauge and rip fence form convenient jigs.



QUICK-SET TOOL REST. Always moves parallel to work. No need for constant adjusting. 15" swing, 3" more than most heavy-duty lathes. Distance between centers, 33". Absolutely rigid lathe bed assures minimum vibration, maximum accuracy. Steel ways take one ton stress.

SHOPSMITH TAKES ALL STANDARD ATTACHMENTS

GET ALL THE FACTS! Compare before you buy. Illustrated, 16-page booklet brings you detailed specifications, describes SHOPSMITH'S many operations. Send for it! It's FREE!

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Cut clean, accurate, parallel grooves—12 widths, any angle. No chatter, burning, chewing—or sanding! No more blade vibration—no screws to fuss with—just four balanced washers. Simply dial desired width with Micromatic adjustment. Can be left on blade for straight cuts. Available in 5 sizes—½", ¾", ⅝", 1", 1⅛". A perfect gift for woodworkers. See your dealer or write—

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GAME ROOM

build your own

HAVE your winter fun headquarters right in your own cellar. You can build a delightful rumpus room at very low cost with Gold Bond Gypsum Wallboard. The strong lightweight panels saw like lumber, are easy to nail in place directly to wood framing. For decoration, use Gold Bond Sunflex, the low-cost, one-hour wall paint. Or, if you prefer, Gold Bond Gypsum Wallboard can be textured or wallpapered beautifully. At low cost you'll have a firesafe room that'll give you many hours of year round enjoyment. You can get Gold Bond in the standard ivory color or wood grain finishes.

Available at your local Gold Bond lumber and building materials dealer

NATIONAL GYPSUM COMPANY
BUFFALO 2, NEW YORK

HYDRAULIC Power Transmission

WITH *Infinitely VARIABLE SPEEDS, Clutch and INSTANT REVERSE*
OUTPUT TORQUE ADJUSTMENT UP TO 180 inch POUNDS

This positive displacement Hydraulic Torque Converter is the ideal fluid drive with thousands of uses. Output Speeds Infinite 0 to 550 R.P.M., in either direction. Change Speeds WHILE RUNNING. Control and Transmit your power this SMOOTH Oil-Way. Will handle ¼ H.P. to 1½ H.P. Motor. Industrial or Home & Farm Use. Cost Government Scale. High Quality Precision Workmanship. Buy this unit to get the most for your money. Case measures 7½" long 7" high 6½" wide. Input & Output Shafts ⅝" dia. Beautiful Red Crackle Finish Case.

FINGER TIP CONTROL

Shipping Wght. 25 pounds

Only **$54.50** Prepaid in U.S.A.

2 quarts oil included FREE

If C.O.D. is requested a 10% Deposit must accompany order and we ship F.O.B. Chicago.

1½"-8 thread Lathe Chuck Adapter, $3 extra

DIRZIUS MACHINE SHOP "T" 1423-25 So. 52nd Ave., Cicero 50, Ill.

5 big power tools in ONE machine using one motor. 63 pounds of **REAL** machinery at low factory-to-you price. Have fun working in wood, metals, plastics; making useful articles, handling home repairs. **Thousands of delighted customers** — our 52nd year. **FREE literature** covers 10-day Free Trial, Money-Back GUARANTEE, Easy pay Plan. **EMRICK, INC., 2110 Clinton, Kalamazoo, Mich.**

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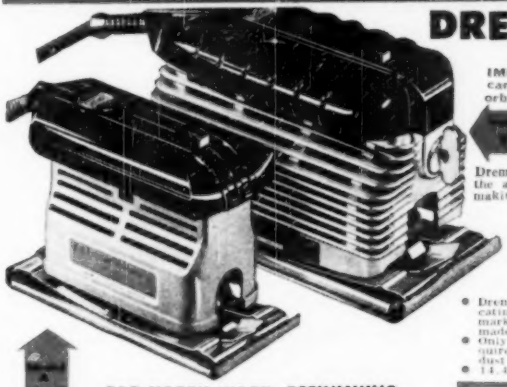
IDEAL CHRISTMAS GIFTS TO GIVE OR GET!

PROFICIENT DESIGNED . . . EASILY OPERATED . . . QUALITY BUILT . . . FULLY GUARANTEED

DREMEL *Electric* SANDERS

STRAIGHT-LINE Action for Guaranteed SCRATCH-FREE Surfaces

IMPORTANT—Before you buy just any sander, remember you cannot get an absolutely scratch-free finish with rotary, orbital, or arc-type sanders.



FOR HEAVY-DUTY CRAFT AND WOODWORKING PROJECTS

Dremel's new Model 2000 is a fast-cutting, production sander. It has the added stroke and extra power required for furniture and cabinet making, boat building or refinishing. Great for building operations, sanding woodwork, dry wall joints, siding and other surfaces. Does a superb wax polishing job, too. Weighs only 5 pounds yet has 21 sq. in. sanding surface. Over-all size 3⅛" x 4½" x 7". **Complete with steel carrying case.** 25 asstd. sheets sandpaper, polishing pad..... **$24.50**

LOOK FOR THESE DREMEL FEATURES

(In Model A and Model 2000 Sanders)

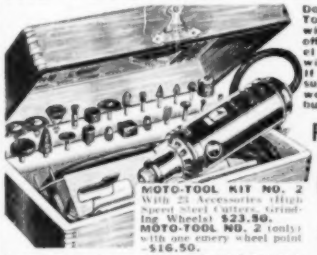
- Dremel's Straight-Line Reciprocating Action leaves no sanding marks . . . removes scratches made by other type sanders.
- Only two moving parts . . . requires no oiling . . . sanding dust does not affect action.
- 14,400 cutting strokes per minute assure faster sanding-polishing.
- Can-type holder permits changing paper in seconds.
- N. U. Underwriter's approved cord . . . operates on 110-120 volt, 60 cycle A.C. . . . fully guaranteed.

FOR HOBBY WORK, REFINISHING AND REDECORATING . . .

Dremel Model "A" Sander is a time and labor saver for hobbyists, home-owners and housewives. Over a quarter million now in use. Like Model 2000, its straight-line reciprocating action will not leave cross-grain scratches and abrasive marks made by other type sanders. Ideal for sanding woodwork, cabinets, unfinished furniture, workshop projects, etc. Weighs only 2½ lbs. Takes the drudgery out of polishing waxed surfaces—furniture, woodwork, etc. Sanding pad 2½" x 5½". Furnished with 6 sheets sandpaper, 1 sheepskin, 1 felt pad..... **$14.85**

DREMEL MOTO-TOOL

THE POCKET-SIZE MACHINE SHOP



Don't confuse Moto-Tools and Accessories with so-called "bargain offers." Compare Dremel feature for feature with competitive tools. If our products are not superior in every way, we don't want you to buy.

MOTO-TOOL KIT NO. 2 With 24 Accessories (High Speed Steel Cutters, Grinding Wheels) **$23.50.**
MOTO-TOOL NO. 2 (only) with one emery wheel point **$16.50.**

Moto-Tool is the most versatile tool you can own—grinds, routs, drills, carves, engraves, polishes, etc. **Look at these features:** Approx. 27,000 R.P.M. ● Dynamically balanced armature eliminates vibration. Oilless (oil-sealed) bearings ● Dust-filtered air-cooling system ● Weighs 13 oz. ● Uses 110-120 v. AC ● Used in plants of General Electric, Ford, Remington Arms, Nash-Kelvinator, etc.

Portable DRILL PRESS

Only $9.95

(Less Moto-Tool)

DREMEL ELECTRIC COPING SAW

CUTS SCROLLS LIKE MAGIC—SANDS AS IT SAWS

JUST GUIDE IT!

Only $5.85 with 2 new blades

FREE PROJECT PLANS

SAFE! AS A HANDSAW

For home, hobby, repair work—no other tool pleases so much for so little cost. Works in any direction delivers 7,200 strokes per minute smoothly, effortlessly. Saws through ¾" medium-hard wood at a foot-a-minute speed. Touch-of-the-trigger, footproof action. Only 2 moving parts, with each one never needs oiling. Uses 110-120 v. A.C.

for 4 special prof-ects, perfect

WHERE TO BUY DREMEL TOOLS

Dremel Tools are sold everywhere. If your dealer cannot supply you, send remittance in full and we will ship postpaid. Or send only $2. and pay postman balance plus postage and fee. **Money back if not delighted after 5 days' trial.**

DREMEL MFG. CO., Dept. 12-L, RACINE, WIS.

BIG VALUE!

MOTO-TOOL KIT No. 1

Moto-Tool Kit No. 1 contains the lighter Model No. 1 Moto-Tool and 34 practical accessories (steel cutters, grinding wheels, etc.) in an attractive, lacquer-finish wood case. It's the biggest value in the field. With 34 Accessories only..... **$17.50**

MOTO-TOOL NO. 1 with one emery wheel point..... **$9.85**

$2.95 EACH

NOW! FILE YOUR OWN SAWS

Do expert saw filing at home. Precision filing easy without experience. Two simple adjustments. Keeps any hand saw extra sharp and true-cutting. Complete with file. Money back guarantee. Cash with order, prepaid. (COD postage extra.) Order today.

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SPECIAL OFFER—Only 10¢
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"The Tools and Rules for Precision Measuring" tells how to make accuracy a habit, shows the methods skilled mechanics use. 100 pictures plus reference tables. Send only one dime. Address Dept. PS.

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POWER PLUS—ABSOLUTELY SAFE—MADE OF LIGHT WEIGHT CAST ALUMINUM!

POWERFUL ELECTRIC MOTOR (do NOT confuse with ordinary, less powerful vibrator type motors.) 3000 revolutions per minute! SAW cuts to center of 16" circle . . . adjustable SAW GUIDE permits cutting ANY length material. Strokes 3000 per minute. 110 V - A.C. TILTING and ROTATING TABLE TOP (6"x8") cuts at any angle. SANDING TABLE tilts through 45°. FOR FAST, EASY FILING simply remove saw blade, chuck and saw guide . . . insert ¼" diameter standard file.

Guaranteed 1 Year against defects in materials and workmanship

Try it FREE for Five Days—Money Back if Not Satisfied!

Wonderful PROJECT PATTERNS. It's Simple To Make Most Anything! Household Items, Toys and Many Others!

All pattern parts are actual size for finished projects. All you do is paste them down or trace them right on the wood! 10 FOR $1

GROUP 1 . . . 10 patterns for beginners
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Sold in leading Department, Hardware and Hobby Stores. If your dealer cannot supply, send coupon direct: FREE 5 day trial...MONEY BACK if not satisfied!

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☐ Enclosed is $14.95 (check or M.O. in full.) Rush 3-in-1 Jig Saw POST PAID.

☐ Enclosed is $2.00 part payment. I will pay postman balance plus postage on C.O.D. delivery.

☐ Enclosed is $.....(check or M.O. in full.)

Rush Group Nos.....Project Patterns at $1.00 each POST PAID.

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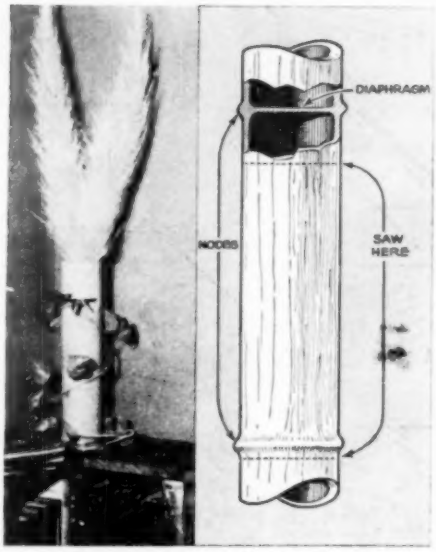
Address.....Zone.....

City.....State.....



Handsome Vase From Bamboo

INTERESTING decorative vases can be made from giant bamboo with very little effort and practically no skill. Because of its natural construction, bamboo comes all ready to use. It grows with a heavy, water-tight diaphragm stretched across each node. All you have to do is select a suitable piece and saw off the vase you want.

The first cut, which must be straight, is made just below a node. The vase can then be sawed off to any desired height—usually below a second node. This cut may be straight or angled for effect.

Head Gasket for Engine Cut from Sheet Asbestos

A SATISFACTORY head gasket for small gasoline engines can be made from asbestos sheeting and water glass (sodium silicate), the sticky solution often used for preserving eggs. Water glass is sold in many drug stores.

A pattern for cutting the gasket can be obtained by lightly coating the cylinder head with oil, dusting on a little graphite powder, smoothing it out with the fingers, and then pressing it down on a sheet of asbestos. After cutting the gasket, dip it briefly in the water glass.

Complete the reassembly as quickly as possible, for the water-glass solution dries rapidly.—*Jay A. Young, South Bend, Ind.*

Success WITH Atlas

▲ *From 3 to 19 employees in back room shop.*

▲ *Over 500,000 vital parts from plant started with one Atlas lathe.*

◀ *From garage shop to modern plant in three years.* ▼

▲ *From 2 lathes and 1 drill press to 30 busy machines.*

◀ *From 2 Atlas tools in 10' x 18' shop to 65 Atlas tools in 50' x 155' plant — and all busy.*

Perhaps you remember these pictures. Published during World War II, they showed how men with machining skill, and vision, and Atlas tools developed plants to handle war production.

Such needs are here again. As the nation strengthens its defenses the big production plants will have to rely on sub-contractors for many special operations and parts, just as they did before.

Atlas metalworking tools — lathes, drill presses, milling machines, and shapers — are ideal for such work. They are capable of the highest precision . . . are compact, need minimum space . . . and they are low in cost. Wherever new equipment is needed for defense production Atlas tools will serve efficiently and economically. Ask your Atlas distributor for complete details.

Use a postcard to send for this catalog today.

ATLAS PRESS COMPANY
1155 N. Pitcher St. • Kalamazoo, Mich.

MATCHED PRECISION TOOLS FOR WOODWORKING AND METALWORKING

FOR XMAS

A COMPLETE CASCO *electric* POWER TOOL KIT

for only $9.95

14 PIECES INCLUDING THE FAMOUS CASCO POWER HEAD

YEAR-ROUND JOY FOR MAN AND BOY!

The most practical power workshop any craftsman or hobbyist can own! It drills, grinds, buffs, polishes, sands, sharpens, etches, etc. All the accessories you need for working on metal, wood, glass, leather, plastic, fibre. 1001 year-round money-saving uses! Operates on AC and DC current. Fully GUARANTEED. Other Casco Power Tool Kits to $19.95. At Appliance, Department, Hardware and Jewelry Stores.

Write today for name of nearest dealer.

FOR A SAFER 'LIGHT' AT NIGHT

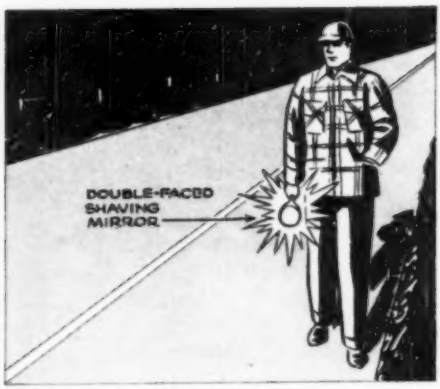
CASCO VIS-O-LITE

Illuminated Automatic

CIGARETTE LIGHTER

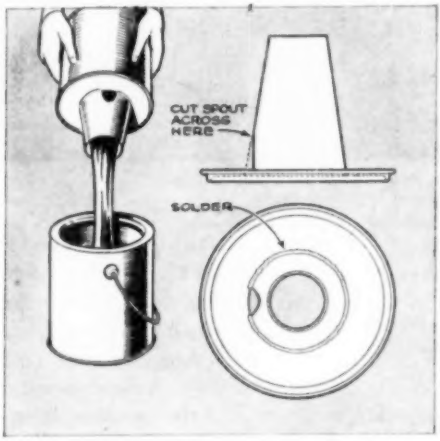
Why be without the convenience of this great new Vis-O-Lite illuminated lighter that makes driving safer day and night? You can replace your old lighter with a new Vis-O-Lite in a matter of minutes with pliers and screwdriver . . . and get the advantages of an illuminated lighter-well that ends fumbling in the dark, prevents scratching dashboards. Made by the manufacturers of the original pop-out lighter that's standard equipment on 4 out of 5 cars. Costs only **$2.75** complete. The illuminated well-assembly alone (minus the pop out unit) costs only **$1.25.** Now on sale at Car Dealers, Auto Supply Stores and Service Stations.

CASCO PRODUCTS CORPORATION
BRIDGEPORT 7, CONNECTICUT
CASCO



Mirror Is Traffic Warning

One night recently I had to walk along an unlighted road to a bus stop. My flashlight was dead and I had no spare batteries. To protect myself from cars, I took along my double-faced shaving mirror. I held it at my side as I walked and it served as a reflector—a car's headlights picking up the mirror.—*P. C. Barker, North Vancouver, B. C.*



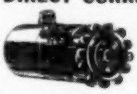
Spouts Save Painters' Time

Whenever I had to pour paint from one can to another, I ended up wiping up too much paint from floor, can, and clothing. I finally tired of this and saved a few standard lids to fit various-sized paint cans. Using curved-jaw snips, I cut a circle from each lid and soldered on a spout, formed as shown. An air hole aids in pouring. If the spouts are graduated in size, the lids will nest for easy storage.—*Robert W. Aiken, State College, Pa.*

Groban's WAR SURPLUS Bargains

ALL BRAND NEW—UNCONDITIONALLY GUARANTEED

DIRECT CURRENT GENERATORS



For welders, plating, truck and marine use, D.C. appliances, lights, etc. Aircraft quality—lifetime grease sealed ball bearings. Heavy duty.

Item #89—Type M-2, rated 50 Amps.—24 Volts. Mfd. by Leece-Neville Co. Shpg. wt. 32 lbs. Gov't. Acq. Cost $176.00 F.O.B. Chicago.... **NOW ONLY** 16.50

Item #90—Type P-1, rated 200 Amps.—28 Volts. 2500 RPM. Mfd. by General Electric, Ford, Delco-Remy and Westinghouse. Gov't Acq. Cost $300.00. Shpg. wt. 70 lbs. F.O.B. Chicago.... 22.50

Item #91—Type R-1, rated 300 Amps.—30 Volts. Mfd. by Jack & Heintz. Gov't Acq. Cost $380.00. Shpg. wt. 70 lbs. F.O.B. Chicago.... 35.00

Each individually packed in wooden box.

UTILITY PUMP ROTARY VANE TYPE

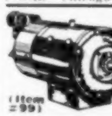
Perfect For Water, Oil or Insecticides

(Item #51)

Sprays DDT, 2-4D, sulphur compounds, etc. Pressures to 150 lbs., 15 gals. per min. at 1200 RPM using 2 HP. As vacuum pump for milking machines, lab use, etc., delivers 26" vacuum, 4.5 cu. ft. per min. at 1500 RPM, using 3/4 H.P. Rotate either direction. 1/2" pipe thread ports, 1/2" standard shaft, 4 ball bearings. Easy to mount—Ready to run. Shpg. wt. 13 lbs. F.O.B. Chicago.... 16.50

D. C. GENERATOR

For 12 Volt Systems



(Item #99)

BRAND NEW. Rated 15 Volts at 50 Amps. Use on 12 Volt circuits on trucks, tractors, ships, planes, battery chargers, auxiliary lights, etc. Base mounting with 4 bolt holes. 5/8" threaded shaft with keyway. Mfd. by **Bendix-Eclipse. Gov't. acq. cost** $136.00. Shpg. wt. 53 lbs. F.O.B. Chicago.... 21.50

HYDRAULIC CONTROL VALVES

(ITEM #24)

ITEM #24. Four-way control valve with built-in relief valve, for use with one double action hydraulic cylinder, may be used with 1500 P.S.I. hydraulic system to open and close hydraulic cylinders. Ship. wt. 8 lbs. A $38 value. **postpaid**.... 7.95

ITEM #26. Four-way control valve for use with two hydraulic double-action cylinders. Each cylinder may be operated independently of the other or in conjunction with the other. Oil may be locked in any of the cylinders to hold the piston at any required position. Ship. wt. 6 lbs. A $60 value. **postpaid**.... 10.95

Hydraulic Cylinders-Air or Oil

Large supply of new labor-saving, economical hydraulic equipment in many types and sizes. Use these positive, highly efficient, smooth pressure hydraulics on presses, arbors, lifts, loaders, power control, positioning, brakes, plastic dies, auto frame alignment, etc., etc.

(Item #42)

ITEM #4—All steel double action hydraulic cylinder, 1 1/8" bore, 2 7/8" stroke. Clevis mounting. Will lift 1000 lbs. with 1000 P.S.I. line pressure. Perfect for positioning and feeding movements. Shpg. wt. 4 lbs. **F.O.B. Chicago**.... 4.95

ITEM #33C—Double action hydraulic cylinder, 1 1/2" bore, 4 1/2" stroke. Clevis mountings at both ends. Uses 1/4" pipe fittings.... **Postpaid** 8.95

ITEM #32—Double action, 1 1/2" bore, 9" stroke, will lift 1760 lbs. with 1000 P.S.I. line pressure. Wt. 4 lbs. A $45.00 value. **Postpaid**.... 10.95

ITEM #41—Double action hydraulic cylinder, 2" bore, 6" stroke, clevis mounting at base and end of shaft. Overall length closed 12 1/2". Has 5/8" stainless steel shaft, uses 1/4" tubing fittings. Will lift up to 3100 lbs. with 1000 P.S.I. line pressure. Weight 7 lbs. **Postpaid** 12.50

ITEM #16—Double acting cylinder, 1 1/2" bore, 27" stroke. (Will lift 1760 lbs. with 1000 P.S.I. line pressure. Wt. 8 lbs. A $55.00 hydraulic cylinder value for only **Postpaid**.... 12.95

ITEM #15—Double acting cylinder, 3" bore, 10 1/2" stroke. All steel hydraulic cylinder, will lift up to 7000 lbs. with 1000 P.S.I. line pressure. Wt. 12 lbs. A $78.00 value. **Postpaid**.... 19.50

Item #31C—Double action hydraulic cylinder, 3 1/2" bore, 11" stroke. Aluminum alloy cylinder wall and all steel 1 1/8" diameter piston rod. Clevis mounting at base and shaft. 19 1/2" overall length closed. Will lift 9625 lbs. using 1000 PSI from Logan Heavy Duty Hydraulic Pump. Uses 3/8" tubing fittings. Value $102.00. Shipping wt. 11 lbs. F.O.B. Chicago.... 22.50

ITEM #6-A—Double action hydraulic cylinder, 3" bore, 25" stroke, will lift 7070 lbs. with 1000 PSI line pressure. Steel barrel, 1 1/8" stainless steel shaft. Gov't acq. cost $176.00. Shpg. wt. 26 lbs. **F.O.B. Chicago** 28.00

ITEM #42—Double action hydraulic cylinder 4" bore, 18" stroke. Rated lift capacity with 1000 P.S.I. line pressure is 12,500 lbs. Ship wt. 30 lbs. **F.O.B. Chicago.** An Excellent Buy for 32.50

HI-PRESSURE FITTINGS for cylinders and valves available at 50c ea. for 3/8" pipe and 65c ea. for 1/2" pipe.

HAND HYDRAULIC PUMPS

Used for hydraulic jacks, presses, hoists and other hydraulic applications. For operating hydraulic cylinders to pump oil or hydraulic fluid under pressure.

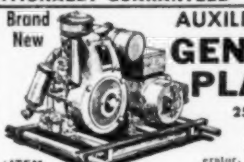
(Item #83)

Item #11—Hand pump has built in check valve and is capable of delivering 1000 lbs. of pressure. Has alloy aluminum housing. Dimen: 8" long x 3 1/2" high x 2 3/8" wide. Ship. wt. 3 lbs. A $45.00 value complete with handle .. NOW.... **Postpaid** 8.95

Item #83—Hand hydraulic pump with built-in transfer valve. **Postpaid**.... 12.95

AUXILIARY ELECTRIC AC GENERATING PLANT

Brand New



(ITEM #88)

For General Utility and Emergency Use

2500 watts • 115 volts A.C. 60 cycles

Plenty of current to operate your: Oil Burner, Sump Pump, Refrigerator, Home Freezer, Power Saw, Lights, Radio and Television, Home Water System Pumps.

Complete integrated heavy duty electric power plant, Signal Corps Model PE-75, driven by Briggs & Stratton, one cylinder 6 1/2 H.P. Model ZZ, 4-cycle engine with killer button, oil bath air cleaner, governor, muffler, starting rope, and radio interference filter. The self-excited Leland or Westinghouse generator is rated 2500 Watts, 115 Volts, 60 cycle A.C. single phase, belt driven, with guard and duplex receptacle. When generator is not in use, you can use the engine separately to power other equipment. Mounted on adjustable steel skids, notched for carrying poles. Net wt. 310 lbs. Shpg. wt. 410 lbs. Dimen. 56" x 19 1/2" x 24". 12 month guarantee. $726.00 value. **NOW**.... 295.00 F.O.B. Chgo.

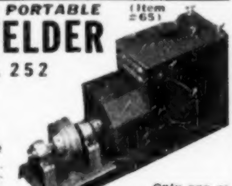
NEW! STATIONARY OR PORTABLE

D. C. ARC WELDER

250 AMPS. MODEL 252

FOR ANY WELDING JOB, LIGHT OR HEAVY

Stop Costly Repair Bills, Weld It Yourself and Save



(Item #65)

Only one or two jobs will pay for entire welder.

Designed for many years of trouble-free service. This precision engineered Direct Current ELECTRIC ARC WELDER is offered at but a fraction of its original value. It can be mounted permanently or easily transported for portable use. Does the job instantly where and when you need it. Has dial type rheostat for easy pinpoint control and a high-low range switch. Run welder at 2500 RPM from drive pulley or power take-off of tractor, a 7 1/2 HP electric motor or a 10 HP gas engine. Use two V belts or flat belt (on pulley).

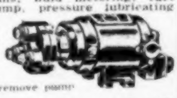
Now . . . AT A FRACTION OF ITS VALUE. Price includes double V or flat belt pulley and instruction book. Shpg. wt. 107 lbs. F.O.B. Chicago.... 99.50

ACCESSORY KIT including welding helmet, electrode holder [illegible] cables with clamp and 5 lbs. of assorted welding rods. **(ITEM #66)**.... Shpg. wt. 17 lbs. F.O.B. Chicago 10.50

If more information is desired write for welder circular.

SELF-PRIMING ELECTRIC PUMP

APPLICATIONS: Oil burners, aquariums, fluid metering, fuel pump, tool post grinder, coolant pump, pressure lubricating pump, general industrial, etc.



Motor Mfd. by Black & Decker: Double ball bearing series wound, continuous duty 1/30 H.P. electric motor, rated 12,000 R.P.M. Transformer included for use on 110 V AC current. Also applicable for 24-32 V DC. **Pump Mfd. by Weldon Tool Co.** with standard 1/4" tubing ports; rated 2 G.P.H.; remove pump and use motor as high speed grinder. **Overall Dimensions:** 7 3/4" long x 3 1/4" wide x 3 1/4" high. Approx. wt. 5 lbs. $51.00 value **(Item #1) postpaid.** 12.95

G-I STAINLESS STEEL TANK

(ITEM #63)

Use these tanks on compressors, for tire inflators, pulsation chambers, floats, sumps, hydraulic reservoirs, fluid and milk containers, fuel containers, etc. Tough, light, shatterproof, 450 P.S.I. Aviator's Breathing Oxygen bottles, type G-1, 2100 cu. in. (approx. 9 gallons) (at. vol. 24"x12". 1/2" threaded openings at ea. end. Wt. 19 lbs. F.O.B. Chgo. 5.95

LOGAN HEAVY DUTY

HYDRAULIC PUMP

(Item #29)

For operating hydraulic cylinders and hydraulic motors on tractors, bulldozers, construction machinery, lift trucks, industrial applications, etc. Delivers 10 GPM at 1200 RPM at 1000 P.S.I. using 6 HP. Has a 3/4" inlet, 1/2" outlet, 3/4" shaft with flat and keyway for direct or pulley drive. Has flange with 4 bolt holes for convenient mounting. Ship. wt. 22 lbs. Overall dimen.: 7" L x 5 1/2" H x 5 1/2" W. A $105.00 value FOR ONLY.... F.O.B. Chicago 22.50

PUROLATOR OIL FILTER

PERMANENT TYPE

The perfect oil filter to keep your motor oil or hydraulic fluid clean at all times. Protect your pump or engine with this unit. Just turn the handle and the element is clean. Standard 3/8" inlet and outlet ports to accommodate 12 gallons per minute. Shipping wt. 4 lbs. A $13.00 value. (ITEM #70).... postpaid 4.95

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1. Add a pint of MOTOR RYTHM thru the carburetor; add a pint to winter grade oil in your crankcase.
2. Allow cleaning action to penetrate 20 minutes before restarting engine. Run motor slowly for several minutes to mix MOTOR RYTHM with oil.
3. You be the judge! If your motor doesn't start quicker, run smoother *the next morning*, ask for a full refund!

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Enclosed is money order____ check____ for $1.50
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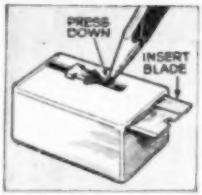
Blade Dispenser Makes Tool



RAZOR blades packaged in dispenser or injector units can be reinserted after they've served their shaving purposes. The dispenser then serves as a handy holder for the blades while you cut articles or recipes from papers or magazines, trim pictures, or rip the seams from clothing. Using the dispenser as a holder reduces the danger of cut fingers. Push the blade from a quarter to half-way out of the dispensing unit. A little practice will reveal the proper amount for each brand of dispensing unit. When the injector-type dispenser is used the protruding part that slips into the razor can be broken off.

When the blade dispenser is emptied of new blades, refill it with the used ones by pushing them back into the dispenser while pushing the ejecting spring or the preceding blade down with a pencil or nail.—*Warren W. Howe, Longview, Wash.*

Natural Plutonium Extracted

PLUTONIUM, hitherto exclusively a man-made atom-bomb ingredient, has now been extracted from natural ore—on a microscopic scale. Microgram quantities of fissionable plutonium 239 have been isolated from large quantities of Belgian Congo pitchblende, previously processed for uranium, the American Chemical Society reports. Although the ore contains only seven ten-billionths of one percent of natural plutonium, this is considerably more than was earlier found in Canadian pitchblende (PS, Feb. '50, p. 147). It is too much to be accounted for by the former theory that natural plutonium is produced by self-bombardment of uranium with its own neutrons.

Fish Have Sharp Noses

TRAINED fish may be used to detect traces of contaminating substances in water that seems all right under ordinary examination and chemical tests. T. J. Walker, University of Wisconsin zoologist, has taught minnows to prefer certain water-plant scents by rewarding them with food. Others were trained to shun certain scents by giving them slight electric shocks. The plants used were all scentless to human nostrils, but the fish knew the difference even when the samples were greatly diluted.

You can't drive this car without going nuts about it!

Even if you've said, "Phooey on light cars!", you'll like this one because it's the light car with heavy car performance. It's engineered to take curves the way a heavy car takes the straight-away. It rides like an angel on a cloud. Drive it and see for yourself! And for economy—30 to 35 miles per gallon! Where else can you buy all this for $1495?

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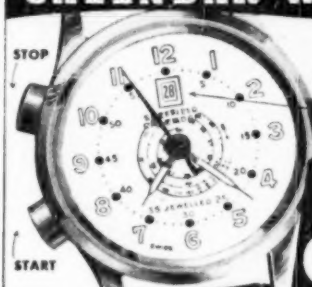
LIFETIME CHRONOGRAPH, STOP-WATCH

CALENDAR WATCH



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Replaces rotted wood, tightens loose screws . . . *easy* to apply!

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Mend cracks, nicks! Smooth finish!

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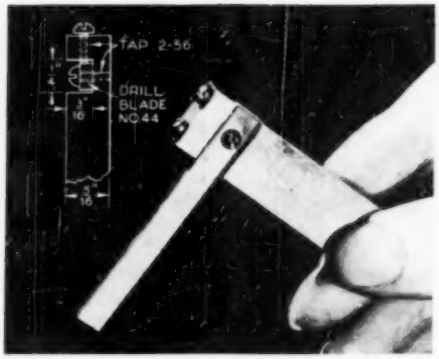
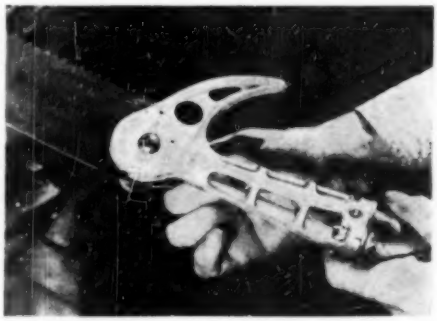


Tiny Square Is Adjustable

MOST homemade squares do not turn out so square, but this one can be adjusted to perfection—and can be reset if dropped.

For the head cut a piece of 5/16" by ½" brass 1¾" long. Mill a ¼" slot 3/16" from the top as illustrated. Drill and tap above the slot for two 2-56 machine screws, 5/16" apart. Now cut a strip of 3/32" by 3/16" brass 2" long for the blade. Drill this a little less than ¼" from the end with a No. 44 drill.

Screw the blade in place and adjust the square by tightening the two top screws while checking with a larger square.



Old Saw Becomes Pole Saw

A DISCARDED handsaw that still has most—but not necessarily all—of its teeth can be converted to a pole saw for trimming trees.

Use a cold chisel to cut the old blade to about 2' long. Make it 3" to 4" at the handle end and taper it slightly toward the other end. Shape the handle end to fit a standard pole-saw holder and attach the holder to a long section of aluminum tubing.

Give the teeth plenty of set and file them as you would a crosscut saw. Note that the teeth of a pole saw cut on the pull stroke.

Sure-grip pistol handle and 3 quickly interchangeable blades — 10-tooth for hard steel, asbestos shingles, nails, bolts, etc. — 24-tooth for thin metals, gutter pipe, BX cable, etc. — 7-tooth for hard and soft woods, fibre board, Masonite, etc. Blade rotates and locks in desired position, handle stays always in the clear . . . makes work easy in tight corners, ends skinned knuckles. A Millers Falls quality tool and one of the handiest you can own. Ask for it at your hardware dealers — the new Millers Falls No. 725 "Nest of Saws" only $2.95* complete.

MILLERS FALLS TOOLS

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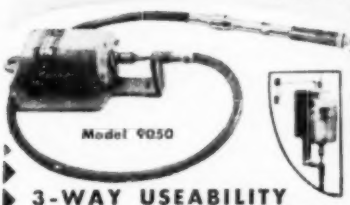
*Prices slightly higher in West and Canada

NOW! Foredom offers a POWER-PACKED 14000 RPM 1/15 H.P. FLEXIBLE SHAFT MACHINE YOU can afford



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Use it to grind, polish, drill, saw, sand, carve, mill, clean, rout, etch, engrave, etc. on all metals, wood, plastics, glass and linoleum.

Includes your choice of 3/32" or 1/8" capacity collet. Add 85c if you want both.

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Catalog 1035-E on request.

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Set 1G 20 Selected High Speed Straight Shank Drills from 1/8" to 1/4". $15 value. New and slightly used surplus. Priced at only **$2.95**

Set 2G 10 Different Size High Speed Straight Shank Drills from 1/4 to 1/2". Extra Long Drills. $30 value. Priced at only **$4.95**

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Set 4G 15 Different Size High Speed Morse Taper Shank Drills up to 9/16" with No. 1 and 2 tapers. $50 value. Priced at only **$6.95**

Set 5G 20 Different Size High Speed Morse Taper Shank Drills from 1/2" to 1". $70 value. Priced at only **$12.95**

Set 6G 10 Different Size High Speed Morse Taper Shank Drills from 1/2" to 11/4". $50 value. Priced at only **$9.95**

Set 7G 10 Different Size High Speed Morse Taper Shank Drills from 1" to 2" with No. 3, 4 and 5 tapers. $180 value. Priced at only **$39.95**

HIGH SPEED TAPER SHANK CHUCKING REAMERS

Set 8G 20 Different Size High Speed Morse Taper Shank Chucking Reamers up to 1/2" with No. 1 and 2 tapers. Priced at only **$6.95**

Set 9G 8 Different Size High Speed Morse Taper Shank Chucking Reamers from 1/4 to 1". Priced at only **$4.95**

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Set 15G 14 Different Size High Speed Standard Thread Hand Taps up to 3/4". Priced at only **$2.95**

HIGH SPEED MILLING CUTTERS

Set 16G 4 High Speed Milling Cutters. Set consists of two side milling cutters, size 2 x 1/8 x 5/8" arbor and two side milling cutters, size 2 x 3/16 x 5/8" arbor. Set of four priced at only **$3.95**

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7 Different Size High Speed Slitting Saws 2 3/4" dia. x 1" arbor. Thickness from .040 to .071. Cuts wood, alumi-num, brass, steel, etc. $25 value. Priced at only **$4.95**

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Right Hand Twist and Cut, 3 & 4 Flute

Set 18G 4 High Speed Double End End Mills, 3/8" shank, sizes up to 3/4". New and slightly used surplus. Priced at only **$3.49**

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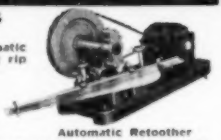
RETOOTH HAND SAWS IN 60 SECONDS

Increase your income with automatic retoother that cuts 4 to 16 point rip or cross-cut teeth in hand saws.

Requires less space, less time and less effort . . . while doing a perfect job. Gives a lifetime of service and has a 1 year guarantee. Free folder on request.



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EARN $6 AN HOUR WITH THE MOTOR DRIVEN BURR SAW FILER

It does a better, faster and easier filing job. No time killing adjustments necessary . . . the accurate operator-controlled file arm will file from both sides. Gives a lifetime of service and has a 1 year guarantee. FREE FOLDER ON REQUEST.

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Set 21G 10 Different Size Hand Reamers up to 1-3/16". New and slightly used surplus. $50.00 value.

PLUS a BRAND NEW ADJUSTABLE Hand Reamers 1-11/32 to 1-17/32" All 11 Hand Reamers priced at only **$11.95**

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Set 22G 5 Different Size Cutters. Can be used as mounted milling cutter or circular saw. All with 1/2" shanks, widths up to 1/4", diameters up to 1 1/2". Priced at only **$3.95**

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COOLANT PUMP OR TOOL POST GRINDER

Black & Decker Electric Motor, 24 volt A.C. or D.C. 1 Amp. 1/30th Hor-epower, Double Ball Bearing Series Wound. Attached to pump manufactured by Weldon Tool Co. Standard 1/4" pipe connections. Rated at 2 G.P.M. **ALSO INCLUDED:** Transformer so motor can be used on standard 110 volt A.C. Applications: oil burners, aquariums, fuel pumps, Skinner Cleanout Type Filter as pictured above also included. **PUMP—MOTOR—TRANSFORMER—FILTER all for only** **$9.98**

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This brand new, compact, powerful pump is rated at 1000 PSI, .507 Cu. In. per Rev., 8 G.P.M. at 3750 R.P.M. Delivers up to 6 H.P. Requires 1/3 to 6 H.P. to drive directly. Change rotation by reversing flow. 5/8" drive spline and 1/2" pipe ports. Wt. 4 lbs. Priced at only **$8.96**

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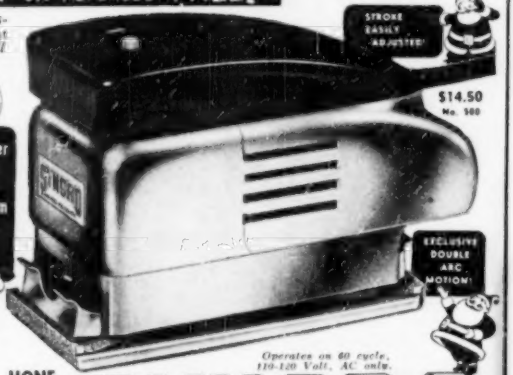

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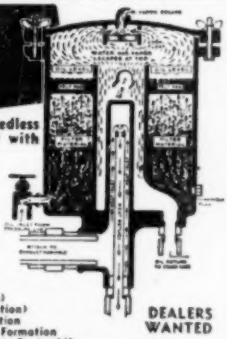
STOP CHANGING MOTOR OIL!

End this needless expense forever with



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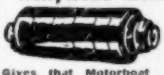

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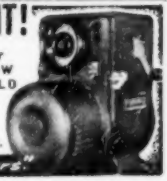

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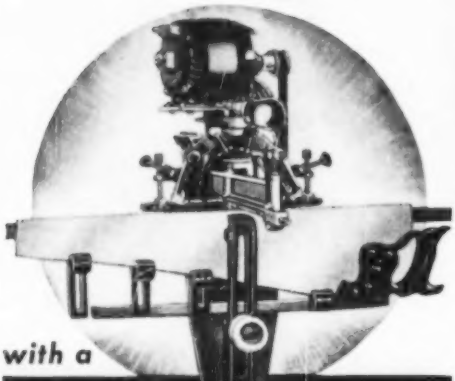

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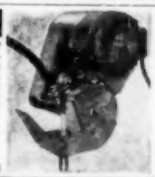

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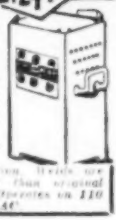

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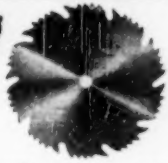

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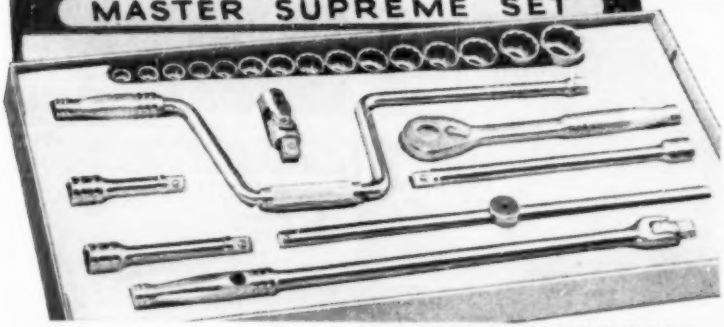

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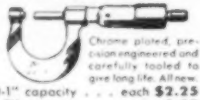

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HOBART — "One of the World's Largest Builders of Arc Welders"

PROFESSIONAL TYPE BUFFING WHEELS AND COMPOSITIONS

For *best* buffing results, depend on DICO — by the world's leading producer of buffing wheels for industry. Whatever *your* buffing job, you'll find the *right* DICO wheel and composition to do it. For free Buffing Manual, write Dept. A-1150.

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Contains 2 big 6" Dico Buffing Wheels, 2 tubes of Dico Composition and Buffing Manual. MAILED POSTPAID if dealer can't supply. Give **spindle diameter** of your power unit.

$2.59 (Reg. Val. $2.85)

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IT'S SPECIAL SALE MONTH AT

SPECIAL! HOT ROD SUPERCHARGER

Here's a hot rod supercharger at a price you can't afford to miss. JUST LIKE THE ONE WITH ARTICLE AND PICTURE ON PAGE 87 OF THE AUG. ISSUE OF POPULAR MECHANICS. Mfg. by Borg & Warner. SPECIFICATIONS: 7½" wide, 5" deep, 4" high. Weight 17 lbs. Compact and sturdy. 4 base mounting holes. ¾" outlet. ⅝" shaft. Includes female Lovejoy coupling. Priced today at $85. OUR SPECIAL SALE PRICE ONLY **$16.95**

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Hollow core rubber wheels made by Goodrich. 2.75 x 10. Ball bearing. ½" or ⅝" bore. 2½" across hub **$3.95**

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For Motor-scooters, Motor-bikes, Lawn Mowers, etc. Mercury centrifugal clutch for use with any small gas engine. 3" "A" belt pulley. ⅝" bore. Brand new only. **Stock #400** ... **$8.95**
¾" bore. NEW **$9.95**

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Grinding and saw arbor, has ½" double end shaft, 11½" long with 2" center pulley. New Departure double roll ball bearing. Right and left hand thread. Self aligning Dodge pillow block. 10,000 RPM. Bearings alone list at $10. Complete arbor new.
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Electric rubber cable. 20 cond., No. 18, solid. 100 feet or more, per foot ..... $ .12
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Electric rubber cable. 4 cond., stranded, No. 18, water and oil resistant; run in parallel No. 16: 100 ft. **$4.25**; 250 ft., **$10.00**; 500 ft., **$19.00**; 1320 ft. reel **$43.00**
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Model No.	Blade Wt.	Motor AC-DC	Cut	
1E	12"	115 Volts	24" Reverse	$ 95.00
22E	18"	115 Volts	18" Straight (Single Gear)	$195.00

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All bronze corrosion resistant Gear Pump. Will lift water 25 feet. Will deliver 1020 gal. per hour at 1200 RPM. Develops 110 lbs. pressure or 250 foot head. Will pump brine, salt water, oil, vinegar, gasoline, etc. Dimensions—10" L. x 7" H. x 5½" W. Base holes 1¾" x 3". Shaft 11/16". 1" x 1" inlet and outlet. Wgt. 24 lbs. Mfg. by Sherwood Brass Works. Required 1 to 1 H.P. Motor. $80.00 Value. NEW. **$24.00** only .....

MORE H.P. MORE PRESSURE

Same pump. Belt drive, with motor
½ **H.P. Motor,** 110 Volt, 220 Volt **$77.00**
¾ **H.P. Motor,** 110 Volt, 220 Volt **$84.00**
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Three phase, 220-440 volt, with flexible shaft; 3450 RPM. Totally enclosed motor.
1 HP List $165 .... Now **$65.00**
1½ HP List $195 .... Now **$75.00**
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⅛ HP, 110 Volt stand & shaft **$39.50**

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Motor driven (not a vibrator). Heavy duty with great power and long life. Adjustable for high, medium or low tone. 110 volt AC current. Weather proof. For alarm or signal horn on boats, school yards, factories, etc. List price $47.00.
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Gas or electric. Awarded from government.

½ HP	12 gal. tank		$ 89.50
1 HP	50 gal. tank		229.00
1½ HP	50 gal. tank		237.00
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Briggs & Stratton. AP. 1¾ to 2½ H.P. NEW. List $119.00 ..... Price **$64.50**
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Spencer turbine blower with ¾ H.P. motor 110 volts, 5000 RPM, 35 oz. lift, 2½" intake, 2½" discharge. Just the thing for garages. Value $225.00 ..... Only **$49.50**

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Gas, oil, or water resistant. Neoprene treated 1½" standard brass fittings
Only **$7.50**

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Send complete Steam Engine as described above, complete with warranty. Postage paid.
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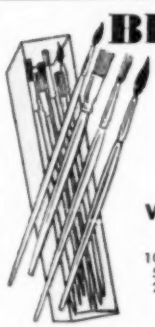

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It's unbelievable. 30 to 75% savings. Use for: Farms, cottages, stores, garages, floodlighting, drilling rigs, refineries, house trailers, fire departments, sound trucks, yachts, tugs, construction, airports, police radios, etc. 2500 Watt, AC 115 volt 60 cycle, single phase. ENGINE Briggs & Stratton, air cooled, 4½ HP. GENERATOR: Westinghouse or Leland, belt drive with guard and Duplex receptacle mounted. NET WEIGHT 310. Gross shipping weight 441. Shipping size 36"x19"x26". Complete with $30.00 worth of spare parts and rubber cable, tools, instructions and fully GUARANTEED. Was formerly priced at approx. $700.00. Now priced for you NEW only.....$295.00
Reconditioned $245.00
Generator NEW.....only $165.00

5 KW 120 Volts 60 cycle AC ENGINE: Hercules 4 cycle, Gasoline. GENERATOR: Mfr'd by Hobart Bros. Unit includes remote control cable, 150' 2-wire, #6 and 150' 3-wire #18, exhaust pipe, power cable plug, remote control stop start switch, automatic volt regulator. Valued at over $300.00. Continuous duty 6.3 KVA at 80% power factor, frequency meter, radio and television filtered. Unit is completely automatic and cannot be damaged by lack of care. Net weight 770 lbs. Shipping weight 1070 lbs. 44" long, 22½" wide, 30" high. 220 volt output can be supplied on all units at a small additional cost. List price today $1900.00. Now priced for you at **$895.00.**

750 to 1000 watt, all single phase, 110 volt AC NEW.....$189.50

VOLTS	WATTS	PRICE
110-220	300	$89.50
110-220	10000	$1195.00
110-220	25000	$2100.00
110-220	35000	$2750.00
110-220	60000	$5500.00

All units 10,000 watts and over, 110-220 single or 3-phase.

ROTARY PUMP

Heavy duty, designed to pump: water, oil, gasoline, etc. Will pump 35 gals. per minute. Can also be used as a vacuum pump. ¾" outlet and inlet on bottom. Dimensions: 7½" wide x 5" deep x 7" high. Compact and sturdy. Four mounting holes in base. Weight approx. 17#. Brand NEW, valued at $85.00. Sale price **$16.95**

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10" ball bearing fan mfg. by Redmond. Can be run vertically or horizontally. 110 volt AC 60 cycle motor with plug and cord. New in original box. Use it for the kitchen as an exhaust fan, heat booster, etc. High pitch blade. 1/25 HP. 1550 RPM, only..... **$11.95**

ALL PURPOSE VISE

Opens to 7½", 4½" wide x 2½" deep. 7" handle, ⅞" sq. thread. Wt. 8 lbs. Use it on the bench as a drill press vise. Ruggedly constructed and an amazing buy. **Stock #870**—
Your price..... **$2.95**

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200 Amp welder with head, cable, electrode holders. Can be mounted or portable. Use on farm, work shop. Will operate from a power takeoff or motor. $300.00 value at only..... **$104.00**

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Engine saws, meter type M1. Brand new. Mfg. by John HOBBS. $20.00 value.....only **$6.95**

Easily mounted 2¼" dial complete with oil pressure switch, wires, and instructions. 1½ ton utility wagon plate aluminum body 24" x 42", ⅝" steel axle. Write for details. RED Seal Continental gas engine 6 to 1 gear reduction. Brand new 1½ H.P. List at $79.00. **$39.50**
Your price.....

200 Amp DC generator Type PI. .....Only **$32.00**

8' Steel Cortson & Sullivan. Chrome clad blade type rule, crackproof. $4.00 value **$2.00**

HEAT BOOSTER

Fits any 8", 9", 10" furnace pipe. 1500 RPM motor with 6' cord, mounting frame, 7" blade. Motor 118 volt 60 cycle 1550 RPM. Easy to install. Silent operation. Warm those rooms with long runs. **Stock #883.** Regular $11.95. Your price **$6.95**

ELECTRIC RUBBER CABLE (all new)

CORD SETS

Extension cords 100 ft. Heavy duty. Plug, socket, and guard. No. 15 wire. Worth at least $10.00. **Stock #310.** Our price.....$5.95
Same as above 50' length **$4.95**

STAINLESS STEEL TUBE

HALF PRICE — 6' to 10' Lengths

SIZE	O.D.	WALL	MILL PRICE	OUR PRICE
¼	3/16	01506	51c Ft.	Ft. 25c
5/16	11/32	01501	63c Ft.	Ft. 34c
7/16	13/32	01508	70c Ft.	Ft. 35c
½	15/32	01205	72c Ft.	Ft. 36c
¾	11/16	05001	91c Ft.	Ft. 46c
⅞	1-3/16	03125	1.01 Ft.	Ft. 50c
1	1-3/16	105	1.10 Ft.	Ft. 55c
1½	1-3/8	050 S	1.74 Ft.	Ft. 87c
2	1-15/16	05003	2.20 Ft.	Ft. 1.10
2½	2-7/16	0500	2.74 Ft.	Ft. 1.37

HEAVY DUTY GRINDER 1 HP. 3400 RPM, 3 phase, 220 Volt 60 cycle, 20 ft. cord, 24" Long. GUARANTEED. Mfg. by Thor & Chicago Pneu. Special SALE PRICE.....**$29.50**

HAND WINCH Atlas frame. Bronze gears 24 to 1 ratio. ¼" stainless cable with hook. Lifts 2000# 12" x 10" Wt. 202. PRICE.....**$27.50**

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STEEL AIR TANK 8"x42", 12 gal. 2¾" openings, 1¾" open each end. 150# pressure **$7.75.** With saddle & legs **$10.95**

POWER PRODUCTS ENGINE 1 HP. 2 cycle, 17 lbs., 2.43 cu. in. disp. 2700 to 3800 RPM. All aluminum. List $30.
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Brand new genuine Neoprene Hose—outlasts ordinary rubber 3 to 1. Reinforced with super tough cotton cord plies. Flexible, easy to handle. Easy Fit brass couplings with standard pipe threads for quick connection. Included. **Pump water for irrigation, stock, tanks, home, barn, fire fighting, etc. Pump Gas or Fuel Oil.** Save more than 60%.

(Inside Diam.)	1¼ in.	1½ in.	1½ in.
Length	25 ft.	40 ft.	30 ft.
Price	$8.75	13.75	13.75

If specified we will send special hose for gas or oil at same prices.

HYDRAULIC HOSE

High pressure, heavy duty, complete with swivel fittings. Pipe thread connections. Ideal for farm equipt., bulldozers, grease guns, etc. Any length. Minimum order $2. INSIDE DIAMETER 1½" **40c** per ft. ¾" **50c**. ½" **70c**. ⅜" **90c**.

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Item 16—40 ft. heavy duty, made of specially insulated No. 14 2-conductor wire. So tough that you can drive over it and yet amazingly flexible and easy to handle. Resists oil, grease or water. Extends electricity up to 400 ft. without voltage drop. Use indoors or out. Complete with heavy rubber plug and outlet. Wt. 2½ lbs. Reg. price $4.50. Special 40 ft. **$1.95.** Comb. 2-40 ft. and 1-20 ft. (total 100 ft.) **$4.75.**

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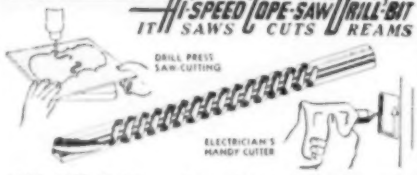
HI-SPEED ROPE-SAW DRILL-BIT

IT SAWS & CUTS REAMS



SAWS, CUTS, REAMS. Sheet metal, angle iron, pipe, wood, plastic, Transite, etc. Amazing high-speed combination bit and saw fits any ¼" or ½" electric drill or slow drill press. Drills own starting hole to quickly cut, saw or ream opening. Easy to operate. Ideal for carpenters, auto mechanics, electricians, plumbers, hobby workers, many others. Abrasive resistant high speed steel. No breaking. Will withstand severe continuous use. Resharpened at no charge. ¼" diameter, over-all length 3½", cutting section 2" long with flutes ground from solid. Shipped same day—money back guarantee.

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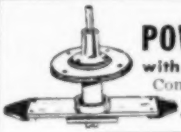

Complete with 18" blade and double ball bearing drive, only **$11.95**
Add 50c for shipping charges

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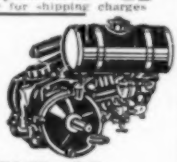
GAS ENGINE



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Genuine Carborundum stone ideal for shop or home use. Send remittance with order and shipment will be made at once prepaid to your door complete with electrical goods catalogue.

Motor driven **$9.75** complete with vise

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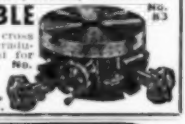
"The Little Marvel" All-Metal welder. 5-year written guarantee. Welds ⅛" thick metal or money back. Repairs tanks, tools, fenders, machine parts, etc. Comes complete with everything — rods, unit, eye shield, and directions. We also make a welder for 16 to 22 gauge metal . . . $3.95 complete. On C.O.D., postage extra.

$6.45 Complete

ESSAY MFG. CO., Inc., Dept. 47, Quincy 69, Mass.

DUAL CROSS and ROTARY FEED

PALMGREN ROTARY, INDEX, MILLING TABLE



Has 8" table, 360° movement and 4" cross feed travel. Adjusting wheels and dials graduated in degrees and thousands. Slotted for bolting to table. **No. 83** Priced **$49.50. No. 82** without rotary feed $39.75.

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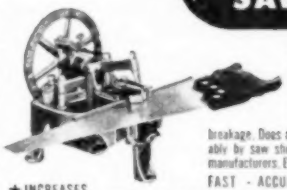
AUTOMATIC SAW SET



Sets 400 teeth per minute on hand or band saws 4 to 16 gauge. Hammer and anvil action sets teeth accurately and uniformly . . . No tooth breakage. Does a perfect job. Used profitably by saw shops everywhere and saw manufacturers. Every machine guaranteed!

FAST - ACCURATE - DEPENDABLE

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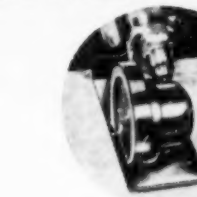
BULL BUFFER

complete with sheepskin bonnet, rubber pad, 2 sanding discs **$9.95**



NEW BULL SAW

Fits any ¼" electric drill. Powerful, portable, easy one-hand operation. Complete with saw blade **$9.95**

AUTOMATIC SCREWDRIVER

for any electric drill, drill press or flexible shaft. When ordering, specify standard or Phillips head **$4.95**

PORTABLE BULL MORTISING KIT

For on-the-job mortising with elec. drill or drill press. Complete with adapter and ¼", ⅜" and ½" chisels and corresponding bits **$23.90**

BULL MORTISING ADAPTER

Fits any ¼" elec. drill and any standard shank chisel. (Bit and chisel prices on request). Only **$6.95**

BULL HIGH SPEED JITTER SANDER

For ¼" drill. Makes perfect, flawless finishes; one-hand operation **$9.95**

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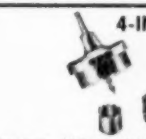
Fits any ¼" elec. drill; does every job from roughing to finishing. Complete with 3 pressure pads and 2 sanding belts... **$19.95**

BULL MANDREL KIT

Includes mandrel, 2½" grindstone, 3" wire brush, 4" cloth buffing wheel **$2.19**



4-IN-1 HOLE SAW!

For any ¼" electric drill or drill press. Complete with arbor and 1", 1½", 2" & 2½" blades **$4.95**

Send 10c for catalog of other new drill accessories.

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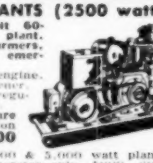
Brand New 110-volt 60-cycle. Army's finest plant. Real buy. Ideal for farmers, contractors, camps, emergency city power.



- Briggs 6.5 h.p. engine. Lefand self excited genera. Automatic voltage regulation. Easy starting.
- Kit of tools, spare parts, full instruction manual. $279.00 $726 value
- Also bargains 3,000 & 5,000 watt plants. A-C 110-v. 60-c generator only—5000, 2000 and 500-w. Write for details.

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Bendix new 115-v. 800-c. 1000-w A-C and 14-v. 500-w D-C—dual voltage generator. Easy to drive. Excellent for 110-v. lighting, radios, D-C useful for battery charging. Original cost $115. Wt. 50 lbs. SALE **$18.96**

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Assemble own unit. Consists of finest one cyl. piston compressor (see below), stainless steel 210 cu. in. tank, 160 lb. gauge, safety valve, paint spray gun, blow gun, 15 ft. hose, assembly instructions, 12-v. shock fittings. Drive with engine or motor. $60.00 Value. Brand New! SALE **$36.90**

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THE PTI SAFETY SAW BLADE

New "Cut-Control" principle practically eliminates all "kick-back" dangers!

The first basic improvement in circular saw blades in years . . . tested and approved by world's leading laboratories . . . now removes most dangers from circular sawing and gives more efficient sawing. Fewer teeth (8 instead of 100), new cutting principle, smooth blade edge between teeth . . . combine to eliminate "kick-back" hazards and minimize extent of finger and hand cuts. Hailed by safety experts as the greatest advance ever made in circular sawing. Ideal for home, school and industrial shops.

Saves power—cuts smoother, cleaner, quieter, too!

This unique new blade lets you slice through the hardest wood with ease . . . and do it with 30% less operating power. Because it has fewer teeth it runs whisper-silent . . . stays sharp longer than ordinary saw blades. Keeps your shop cleaner by producing chips instead of saw dust!

Order this amazing new safety saw blade today!

Here are the prices and sizes, delivered, postpaid.

7" diameter blade....$4.65— 8" diameter blade....$5.35
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In ordering, be sure to give the *diameter* and *bore* of the blade. Send check or money order or we will ship C.O.D. *Money back guarantee*, either way.

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Gentlemen: Rush me the following units:

Quantity	Blade Diameter	Blade Bore

Please check:
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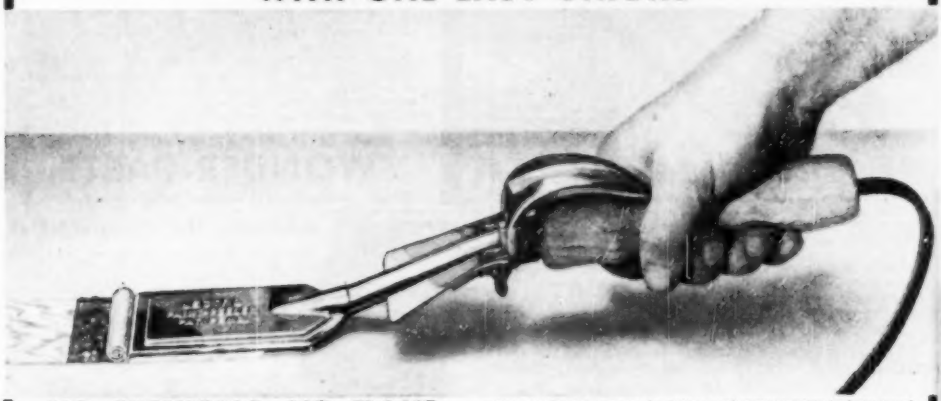
DON'T WORK HARD SCRAPING

PEEL PAINT TO BARE WOOD

WITH ONE EASY STROKE



NO CHEMICALS—NO FLAME

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at home, office, and shop
(IDEAL GIFT, TOO)

So handy to keep nuts, bolts, screws, nails, parts, washers, stamps, hobbyists' needs, etc., at your fingertips.

THIS 32 DRAWER UNIT ONLY $8.95 POSTPAID

Stop searching, get a 32 or 64 drawer Jiffy to keep those small items that usually get mislaid. Spot welded steel, gray enamel finish, metal drawer guides. Dividers included with aluminum drawers make possible three compartments per drawer. Looks good anywhere. Send check or money order, please—no C. O. D.'s. Prices below. Your money refunded if not satisfied. Dealers write for quantity discount.

SPECIFICATIONS	WITH ALUMINUM DRAWERS	NEW SPECIAL!
32 Drawer Unit 6" Deep 12¾" Wide 15¼" High **64 Drawer Unit** 6" Deep 25½" Wide 15¼" High **Drawer Size** 1¼" Deep 2¾" Wide 6" Long	**Dividers and Index Cards Included** One piece rustproof aluminum drawers for heavy service—good for work bench and industry use. **32 drawer - $8.95** **64 drawer - $15.95** Ohio orders add 3% sales tax. Marproof Rubber Feet included with all cabinets **POSTAGE PAID**	**ONLY $2.95** **8 DRAWER UNIT** (24 compartments) **16 DRAWER UNIT** (48 compartments) **$4.95** **Specifications** 6" Deep, 8½" High 8 Drawer 6¾" Wide 16 Drawer 12¾" Wide **POSTAGE PAID**

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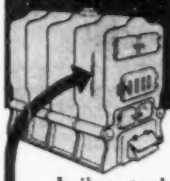
Save Fuel Costs



Seal up every heat-wasting crack, opened seam and other leak in your furnace, boiler, tank, radiators and piping *tight*—as professional repair men do—with Smooth-On No. 1 Iron Cement. Do it yourself—now—and cut this winter's fuel bills. You apply Smooth-On like putty, it hardens like metal, and *stays* tight, because it expands slightly as it sets. Buy Smooth-On No. 1 in 1¾-oz., 7-oz. or 1-lb. size at your hardware store. If they haven't it, write us.

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VISE-GRIP WRENCH

Does it QUICK and EASY

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If not at your dealer's order direct.

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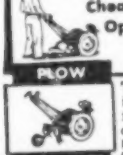

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Avoid hours of hard scraping. Apply WONDER-PASTE with a paint brush, and the toughest paint, varnish, enamel, lacquer, or shellac becomes a soft sludge that peels off easily with a putty knife. Leaves surface so clean no sanding is needed. Won't run on upright surfaces. Harmless to your hands or fabrics. Try it—see why it's called WONDER-PASTE! At paint and hardware stores everywhere.

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ARC·WELDER For Light or Heavy Work

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Whatever any vise can do with wood—**Versa Vise does it better, easier.** There's nothing like it. Vertical work? Just lay it on its side on the permanently attached post. Horizontal? Place it upright on the same post! Turns a full circle in either position. Tightens automatically on the post when you tighten the jaws. Beautifully machined 2½x3¾" jaws open to full 5". 16 lbs., finest cast semi-steel. Only $9.95, f.o.b. Orrville. Buy it from your dealer, or send $9.95 now and pay small shipping cost on delivery (Ohio residents add 3% sales tax). Handiest woodworking vise you ever used. Money-back guarantee. Thousands sold. Made by makers of the famous Will-Burt stoker. Ask any bank.

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Thousands in use since 1936

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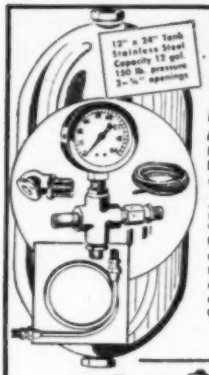
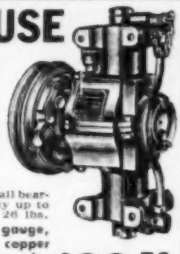


WESTINGHOUSE Air Compressor



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Model T-1 Brand New — 2 CYLINDER PISTON TYPE **$21.50**

Operates with ½ H.P. Motor or equivalent gas engine.

Compressor has 2" bore, 1½" stroke, ball bearing, 3.27 CFM at 600 R.P.M. Capacity up to 6.54 CFM. Size 9"x11⅞"x6⅝". Wt. 26 lbs.

Compressor, pressure tank, air gauge, air chuck, 20-ft. hose, pop valve, copper tubing with 4 brass flared fittings for connecting compressor to tank, 4-way cross and 3 nipples.

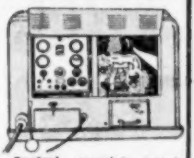
COMPLETE OUTFIT, wt. 52 lbs. **$32.50**

EQUIPMENT LESS COMPRESSOR, $12.50
COMPRESSOR SEPARATELY, $21.50
TANK ONLY, $5.95

LIGHT PLANTS

Brand New! War Surplus

Signal Corps Power Unit PE 197



115 volt 60 cycle A.C. single phase 5 K.W. Hobart, water cooled, 14 h.p. 4 cylinder Hercules engine. **Remote Control,** complete panel board with instruments, 150 ft. automatic remote control cable with reel; 150 feet #6 heavy duty wire with reel; housed in metal case with replacement parts and tools. Cable with reels alone worth $400. Regular price of unit $1000. Shipping wt. 1250 lbs. Our price, complete, f.o.b. Chicago **$895.00**

2½ K. W. LELAND POWER PLANT **$295.00**

10 K. W. Light Plants 110/220 V.	**$1295.00**
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37 K. W. Diesel Light Plants, 110/220 V.	**$3000.00**

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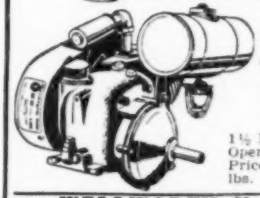

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6 to 1 Reduction Gear

4 CYCLE

1½ HP with 6 to 1 reduction gear. Operates at 450 R. P. M. List Price $79.50. Shipping weight 54 lbs. SPECIAL PRICE **$39.50**

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Takes starting load off engines or motors. When speed is reached, a flip of handle shifts clutch from idling to driving position. Handles "A" belts. 2.35" pitch diameter. ⅝" bore. Ideal for use with lawn mowers, garden tractors, home workshop motors, etc. 3¼" long. Safe, easy to mount, sealed bronze bearings, positive action. Shpg. wt. 3 lbs. **$7.50**

SAME CLUTCH FURNISHED WITH ¾" BORE $8.50

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PORTABLE HAND SAW

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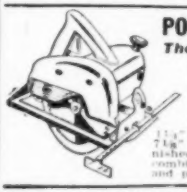
PORTABLE ELECTRIC HAND SAW

The Zip Sawer With ALL the Features



6¼" Diameter saw blade. ½" square arbor hole. Maximum depth of cut 2⅛". (At 45°, 1¾".) Minimum depth of cut 0". Angular adjustment 90° to 45°. No-load speed, 5200 r.p.m. Full load speed, 3200 r.p.m. Amperes, full load, 8.0. Universal A.C.-D.C. motor, 110-120 volt. Dimensions: 11½" long; 9½" wide (ripping guide removed); 7⅛" high (without blade). Furnished complete with 6¼" diameter combination blade, and 10 ft. cord and plug. Wt. 11½ lbs. Price **$39.95**

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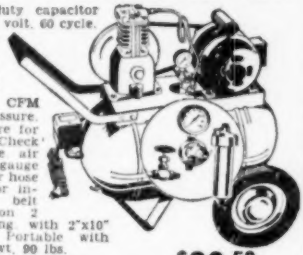

⅓ H.P. heavy duty capacitor motor, AC 110/220 volt, 60 cycle. 2x1¾ inch piston type compressor, splash feed lubrication. 12x24 inch tank, automatic pressure switch. CFM 2.8 at 100 lb. pressure, or 150 lbs. pressure for intermittent duty. Check valve, safety valve, air regulator with gauge and filter. 20 ft. air hose with air chuck for inflating tires. V belt drive. Mounted on 2 wheels, ball bearing, with 2"x10" pneumatic tires. Portable with handle. Shipping wt. 90 lbs.

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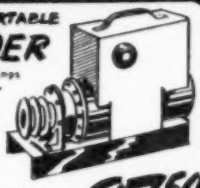

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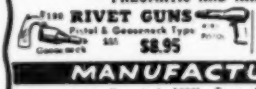

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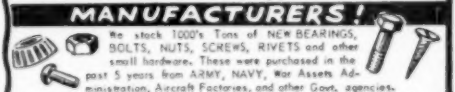

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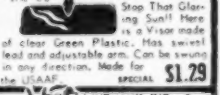

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Bevel cuts! Adjustable—¾" to 1⅞"
Perfect for repairs, remodeling, hobbies!
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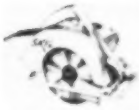

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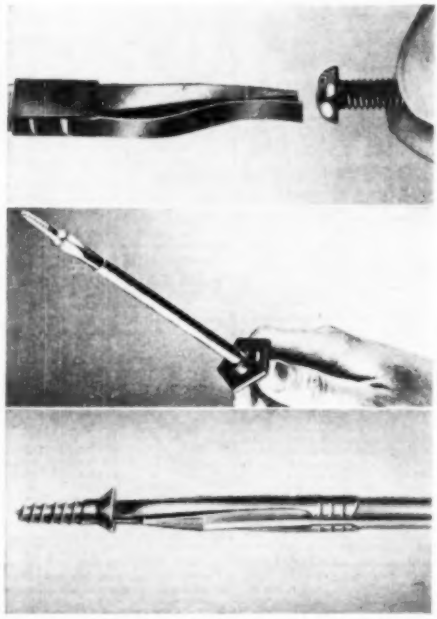


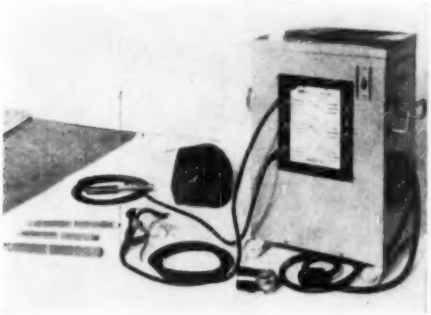
Screws Held on Screwdrivers. The three tools pictured above all hold a screw to the end of the bit. They're designed to keep the screw from dropping, especially when you are driving or backing out a screw in a hard-to-get-at spot.

Top: This one is made by Vaco Products Co., of Chicago. The steel spring clip that holds the screw can be pushed up the shaft out of the way when it's not needed.

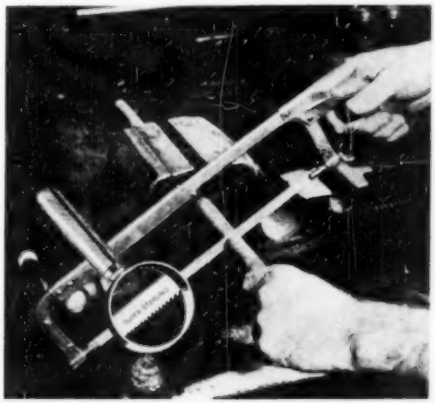
Center: This one is made by the Kedman Co., Salt Lake City, Utah. It consists of two half-round blades inside a sliding steel tube. After the bit is placed in the slot of the screw, the tube is moved forward, causing the blades to spread slightly, gripping the walls of the slot.

Bottom: This one is made by the Harris Products Co., of Chicago. It may be slipped over a standard screwdriver blade. The two expanding units grip the walls of the slot to hold the screw. The attachment may be slipped up the shank of the screwdriver when it is not needed.

Tools



Kit for Arc Welder. The basic parts needed to assemble an arc welder are included in a construction kit priced at $58 by the Atomic Arc Welder Co., of Omaha, Neb. According to the company, the unit will weld up to ⅜" steel plate on a single pass and will quickly cut ½" plate. More than 135 lb. of parts are included.



Saw Blade Has Graduated Teeth. Smoother, cleaner cuts are possible with this hacksaw blade, its maker reports. Each tooth along the blade takes a larger bite than the one before, eliminating sticking and binding. The blade is available in 10" and 12" sizes with graduations from 24 to 20 and from 18 to 14 points. Maker is the Diamond Saw Works, Inc., Buffalo, N. Y.

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Same Kit with 10" Combination Blade $24.90
Same Kit with 8" Combination Blade $23.90

GIL-BILT 8-INCH TILTING TABLE SAW

- 21x27 in. table tilts full 45 degrees. 13 in. capacity in front of blade
- 8 in. blade cuts from 0 to 2½ in.
- New Departure ball bearing arbor ¾" precision shaft turned down for ½" bore blades, alum. housing ready to run
- Cast aluminum miter gauge and self-aligning rip fence guide (one piece)

GIL-BILT Metal Parts Kit includes Plans, Ball Bearing Arbor, Miter Gauge and Bar, Rip Fence Guide, Machined Lock Knobs, Tilt Support Segments and All Other Metal Parts (less blade) $15.95
Same Kit with 8" combination blade $18.90

GIL-BILT 12-INCH BAND SAW

- Cuts to center of 24 inch circle
- Handle—stock up to 6 inch thick
- 18x18 inch table tilts 45 degrees
- Lower wheel and drive pulley runs on sealed New Departure Ball Bearings. Upper wheel runs on two ¾" bore Oilite Bronze bearings
- Upper wheel tension and bal mechanism of cast aluminum, completely assembled
  - Upper and lower blade guides. Each has ball thrust bearing, self-lub bronze jaws.
  - Rubber tired wheels. Choice of cast aluminum or make-your-own wood wheels on metal hubs
- Uses standard 78 inch blades up to ¾ inch wide
- Fully enclosed mechanism for utmost safety

GIL-BILT Metal Parts Kit includes Plans, rubber tires, 14 inch blade, hubs for wood wheels, ball bearing spindle, tilt mechanism, guides, table tilt segments and all other metal parts $16.95
Same Kit with two machined ready-to-install 12" cast aluminum wheels $20.95

NO DEALERS—One Low Factory Price! Return in 10 days for refund of purchase price if not satisfied. Prices include postage within 600 miles. Over 600 miles add 5%. Send cash, check, or money order for parts kit, or send $1.00 for Simple Step Plans and order kit later less cost of Plans. Plans sent postpaid anywhere in the world.

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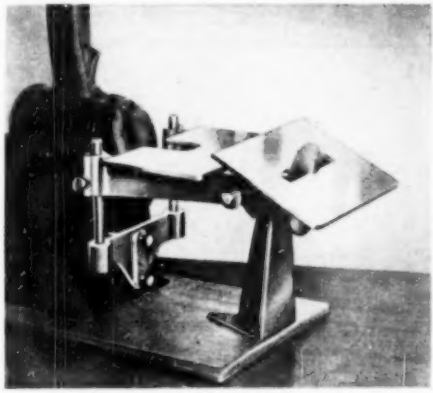
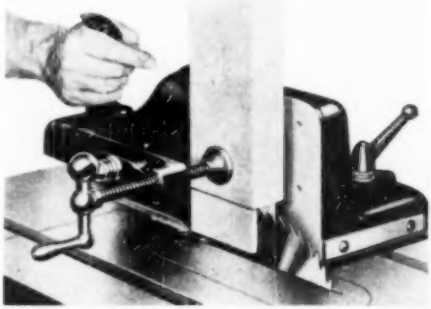
(Manufacturer of Permanent Magnets)

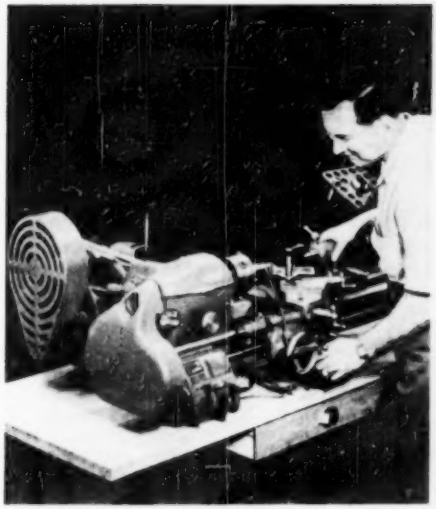
New Tools



Saw Fits on Drill Stand. The Minisaw has a 3" blade with a 1" depth of cut for use on soft metals, wood, and plastic. It's designed to attach to a Black & Decker or a Skil Saw horizontal drill stand. The table tilts up to 45°. Attachments include a 4" sanding disk and a miter gauge. The tool, with all attachments, is priced at about $13 by Clayton Distributors, Inc., of North Hollywood, Calif.



Cuts Parallel Tenons. With this tenoning jig you can cut tenons on any table saw that has a ¾" by ¾" miter-gauge groove. The jig takes stock up to 2¼" thick and in any width within the capacity of the saw. By adding spacing collars and a second saw blade, you can make both tongue cuts in one pass. The maker is the Delta Power Tool Division of the Rockwell Manufacturing Co., of Milwaukee.



Lathes Have 10" Swing. A line of lathes taking work up to 10" over the bed, and known as the "Light Ten," is offered by the South Bend Lathe Works. With a swing over the cross slide of 6¼", the lathes come in three lengths and both quick-change and change-gear types. Headstock bearings are bronze, end play being taken up by a ball thrust bearing and nut. A choice of a 12-speed flat-belt or 16-speed V-belt drive is available. Spindle bore is 27/32", collet capacity ⅝". For drilling, the tailstock screw has a micrometer collar graduated in thousandths. The familiar handscraped V ways of this make are retained.

Vise Fits Drill-Press Column. It's never necessary to bolt this vise to the drill-press table, and it can be quickly swung into position under the drill. It fits columns from 1⅝" to 4" in diameter. The jaws can be closed and locked by a slight turn of the handle. For production jobs, a lock is provided to keep the vise from moving out of position. The 4" jaws have a maximum opening of 6". Universal Vise & Tool Co., Parma, Mich., is the maker.

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P.S. Last minute news & notes...

TELEVISION SETS cost more this fall because of the great demand and the difficulty of obtaining parts. Korean war and FCC's announcement that it favors the CBS color system have made future developments hard to forecast. Sets now available will not receive CBS colorcasts unless adapters (to show color pictures in black and white) or converters (to reproduce the colors transmitted) are added to them. The FCC may decide the color question for keeps next month.

SOME POWER TOOL makers were quick to jump prices. Too quick, says one manufacturer, citing plentiful inventories of materials, and assuring dealers that pre-Korea prices will hold for some time.

AUTOMOBILE MEN themselves did not think automatic drives would win public approval so quickly. A big factor is the buyer's conviction that a new car with a clutch pedal will bring a lower price at trade-in time two to five years from now.

WINGS of future warplanes may be rivet-less. Lockheed and others have found a new way to forge aluminum wing panels. And Northrop's researchers are working on plans to cast entire wings from magnesium.

TRITIUM, the very heavy kind of hydrogen that may be used in H bombs, has been detected in water. Cosmic rays apparently produce very small amounts of it--so little, in fact, that it is the rarest chemical element found thus far in nature. To develop an H bomb, the experts say, the AEC will have to manufacture it much faster than cosmic rays do.

SAILORS' LINGO will be adopted by airmen of many nations next July. Nautical miles and knots will be substituted for statute miles and miles per hour. A nautical mile is 6,080 feet and a knot is the number of nautical miles traveled per hour. The Civil Aeronautics Administration has ordered this change for U.S. aircraft as a step toward standardizing aircraft communications all over the world.

FLYING SAUCERS travel between planets by magnetism, and are flown by little men 3½ feet high, according to Frank Scully, a Hollywood humorist who has written a book about them. Scientists consider his tales preposterous.

TIRES made partly from spruce trees may be better than those you have now, Texas University chemists say. They have found that PADMS (para alpha dimethyl styrene), a by-product of the paper industry, can be used to make synthetic rubber. It has not been tested extensively yet but experimental batches of rubber made this way turned out well.

A-BOMB SHELTERS are being built under the garages attached to the new homes being erected in one New York suburb. They have 18-inch concrete walls and roofs two feet thick . . . TV TURNTABLES are being built into the walls of new homes in another suburb. They will enable occupants to watch a video show from the living room, dining room, or kitchen.

BY JANUARY 1, the Bureau of Roads estimates, the United States will have 48,484,000 registered cars, trucks, and buses. Forty years ago we had only 468,500; 30 years ago, 9,239,161; 20 years ago, 26,531,999; and 10 years ago, 32,035,424.

THE U.S. NEEDS three times as many scientists as it has now, says Yale Prof. John S. Nichols. The Russians already have access to much of the same "knowledge stockpile" that we do and by 1953, he fears, "their stockpile of scientific manpower will exceed ours in number."

The Editors

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MILWAUKEE

No. 34-305 10" Tilting-Table Saw — A low-cost dependable machine. Cuts stock 3¼" thick. Table 20" x 27". - $190.90*

No. 34-405 10" Tilting-Arbor Saw — The famous profit-making Unisaw®. Massive table 27" x 36". - $234.00*

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No. 34-265 8" Tilting-Arbor Saw — You get more saw for the money. Big table, 25" x 33". Cuts stock 2-5/16" thick. Rips to center of 54" panel. $157.40*

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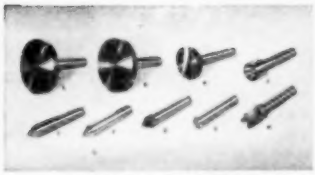
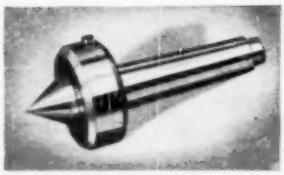
**Motor and switch extra. All prices subject to change without notice.* 8-6



CENTERS AND DRILL PADS

STEEL AND BRASS COLLETS



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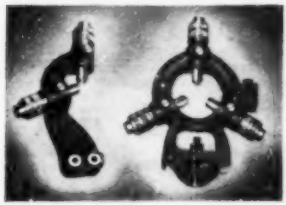
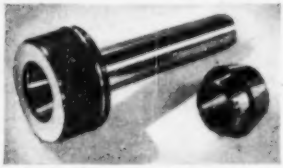


FOLLOWER AND STEADY RESTS



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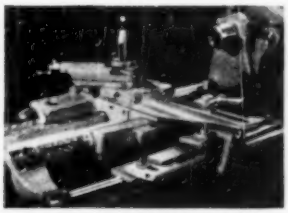
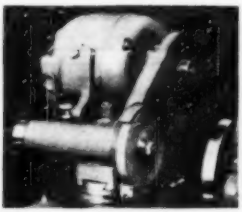


TELESCOPIC TAPER ATTACHMENT



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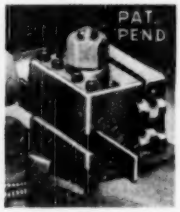

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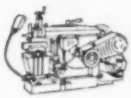

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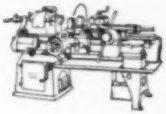

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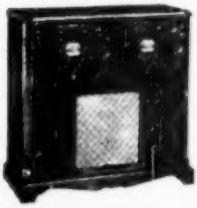

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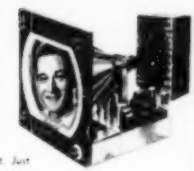

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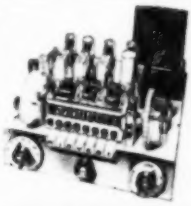

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Springfield, Mass.—To your potential customers: Let this Ask the man who owns one—and I'll answer for every Midwest Radio owner that Midwest is the most in radio for the least price.

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"Amazed At The Precision Picture Control"

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